SCIENTIFIC AMERICAN

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"Texas." "Massachusetts." "Brooklyn." "New Orleans." "Harvard" ("Paris"). "Iowa." "Marblehead." "Castine." "Eagle."

SCHLEY'S FLEET ENGAGING THE SANTIAGO FORTS AND THE "CHRISTOBAL COLON."—[See page 375.]

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THE SANTIAGO CAMPAIGN.

It is gratifying to learn that several thousand troops have been dispatched to assist in the reduction of Santiago and the capture of Cervera's fleet, and that a second division will follow at an early date. It is stated that the force includes a battalion of engineers, some batteries of light and heavy artillery and several detachments of infantry. Accompanying the troops is a complete engineering equipment. The heavy batteries are supplied with 5-inch siege guns and the light batteries carry 3·2-inch guns.

This indicates that the plan of campaign contemplates the reduction and capture of the forts at the entrance of Santiago Harbor, a step which, as we pointed out last week, is absolutely essential, if it be true that the entrance channel has been thoroughly mined by the Spaniards. It would be taking a needless risk to send our ships one by one through a narrow channel sown with mines. By the capture of the forts we can obtain possession of the cable connections which control the mines, and with the firing station in our hands and the guns silenced, our fleet could enter the inner harbor intact and give battle to Admiral Cervera's ships in the best possible fighting condition.

Since the successful reconnaissance made by Commodore Schley, our squadron off Santiago has been strengthened by the arrival of Admiral Sampson with several powerful ships. The combined fleet before Santiago now includes the first-class battleships "Iowa," "Massachusetts" and "Oregon," the second-class battleship "Texas," the armored cruisers "Brooklyn" and "New York," the protected cruiser "New Orleans," the unprotected cruiser "Marblehead," the auxiliary gunboats "Mayflower," "Eagle" and "Vixen," the auxiliary cruiser "Harvard," the torpedo boat "Porter" and other craft of less importance. The guns in the four battleships, two armored cruisers and the protected cruiser available for an attack on the fortifications are more powerful and probably more numerous than those on the fortifications and the "Christobal Colon." There are mounted in these seven ships no less than one hundred and eight guns of 4-inch caliber and upward, the list including eight 13-inch, six 12-inch, thirty-eight 8-inch, twenty 6-inch, twelve 5-inch, four 4·7-inch and twenty 4-inch. The concentrated fire at close range of this tremendous battery, forty-two of which are rapid-fire guns, aided by an attack by the siege guns of our troops on shore, should make short work of the fortifications, powerful as they are. What was left of the forts would be easily carried by assault from the rear.

The fall of Santiago and capture or destruction of the Spanish fleet in the West Indies would be as decisive and far reaching in its effects as the brilliant victory of Dewey in the Philippines.

SMOKELESS POWDER.

Although the war is not many weeks old, it has been waged long enough to impress upon the combatants many important truths which were understood in a vague way before the conflict, but were never appreciated at their full worth until now. We have drawn attention in a previous issue to the lessons of Manila Bay, chief among which is the vital importance of good marksmanship as the decisive factor in a naval fight. The excellent work of our gunners was nothing more than we all expected; it was in keeping with the traditions of our navy, and in the present war, just as in all those that preceded it, the efficiency of our gun crews is the result of much patient and careful practice at the targets during the ordinary routine of peace maneuvers and cruises.

It is our duty, however, to draw attention to the fact that our ships are laboring under a serious disadvantage in having to use the smoke-producing and obsolete brown powder with which they are supplied, instead of the modern smokeless powder, which is in universal use throughout the world. In every engagement which has taken place, not even excluding the Manila fight, eyewitnesses have noted the fact that our ships were speedily enveloped in dense clouds of smoke produced by the fire of their own guns. The smoke in some cases hung like a pall about the ships, completely shutting out the object of attack from our gunners and preventing them from observing the flight of the projectiles. This was the case at times at Manila, it seriously impaired our work at San Juan, and the same trouble occurred in the recent reconnaissance at Santiago. The objections to brown powder were powerfully illustrated in the last named conflict, owing to the fact that one of the ships, the "New Orleans," was using the smokeless powder (cordite) which has been adopted in the English navy. She was not at any time shrouded in smoke, and eyewitnesses spoke in glowing terms of the accuracy and rapidity of her fire.

How it comes that our ships, with the one exception mentioned, are supplied with old fashioned powder when powder of a far more efficient type has been in use in other navies for five or six years is a question that we are unable to enter into fully at this time. There has been a reluctance on the part of our authorities to supply the ships with high explosive powder, because of its dangerous character; but of late years improved powder of this class has been carried on foreign warships in all climates and weathers with perfect safety, and the time has surely arrived when we can venture to adopt that form of smokeless powder which our experts have determined to be the best.

The advantages of the smokeless over the old type are many and valuable. The discharge of a brown powder, especially in the larger guns, is accompanied with enormous volumes of dense, opaque smoke, whereas the smokeless powder produces only a faint mist or haze, which is quickly dissipated. The one produces a large amount of residue which fouls the gun, the other produces but little residue and leaves the gun practically clean for the next round. The smokeless powder is far more powerful weight for weight, the charge of brown powder for our 12-inch gun weighing 425 pounds, whereas the charge of cordite for the 12-inch wire gun weighs only 167½ pounds. Smokeless powder burns very slowly, giving off its gases gradually, maintaining a fairly even pressure throughout the whole bore of the gun, thereby enabling a high muzzle velocity to be obtained with a comparatively low maximum pressure in the gun; whereas the brown powder burns more quickly, producing a less uniform pressure throughout the travel of the projectile in the bore. Fifteen tons to the square inch is the limit of pressure which our guns are designed to stand in service. With brown powder this pressure is reached at the instant of firing, the charge is less gradually converted into gas, and as the projectile travels along the bore the pressure rapidly falls, owing to the increased volume of the space behind the shot. With the smokeless powder, a much higher velocity may be obtained without exceeding the normal pressure of fifteen tons. This is due to the fact that the powder burns more slowly, more gas being given off as the shot travels along the bore. The pressure is maintained at a high level up to the time that the projectile leaves the muzzle, and consequently the velocity is proportionately increased. The muzzle velocity of the 6-inch gun on the "Massachusetts," which uses brown powder, being 2,090 feet per second, whereas the 6-inch gun on the "New Orleans," using smokeless powder, has a muzzle velocity of 2,642 feet per second.

By the introduction of smokeless powder the muzzle velocity of our guns could be raised from 400 to 500 feet per second without exceeding the safe maximum pressure for which the guns were designed. Increased velocity means a more level trajectory and a greater penetration. When to these advantages are added a smokeless discharge and the ability of the gunner to take note where the projectile strikes, the immense superiority of the smokeless powder is manifest.

Excellent smokeless powders have been produced in comparatively small quantities by our government experts; but the private manufacturers have not as yet turned out successful smokeless powder in large quantities. If they apply themselves to the task in good earnest, they can undoubtedly equal or surpass the products of European factories. It is to be hoped that a healthy rivalry will spring up in this important industry, and that before long an efficient, stable and thoroughly reliable smokeless powder will be in general and exclusive use in the heavy guns of both our army and navy.

THE CENTRIFUGAL METHOD OF COLLECTING PLANKTON, THE BASIS OF FOOD SUPPLY FOR AQUATIC ANIMALS.

The Rhode Island Experiment Station is carrying on investigations, not only on land, but also on water farming, since in the near future increasing attention must be given to all possible sources of food supply for man.

As indicated by his annual report for 1897, Dr. Field has been experimenting upon reliable methods for determining the relative economic value of water areas (i. e., of ascertaining how many fish, crabs, oysters, clams, etc., any given particular area of water can sustain). This is of special interest to Rhode Islanders as a relatively large area of the State is shallow water particularly adapted to aquiculture, i. e., marine farming.

The conditions governing the occurrence and growth of the microscopic plants and animals which constitute the fundamental food supply of the edible marine fish and shell fish are manifold, and necessitate local observations and records. Yet the conditions warrant this labor, for in its scientific and economic aspects the question is one of great importance. It has been shown that water areas under cultivation yield per acre a far larger quantity of nitrogenous food for man than does a corresponding area of land.

The writer points out that attempts to collect the matter in suspension in samples of water, for strictly accurate determination, either by biological methods with nets and filters, or by chemical means, have been prolific of errors, and that practically little advance has been made, chiefly owing to inadequate methods of collecting, the average error being at least fifty per cent.

By the use of a special, large centrifugal machine,

devised by Dr. C. S. Dolley, of Philadelphia, and by him sent to Dr. Field for trial, the error in the results is practically eliminated. This machine, driven by hand or by motor, quickly separates all the suspended matter, living plants (including the bacteria), animals and inorganic matter, in such a way that it can readily be weighed, the total volume determined, the number of particles counted under the microscope and tables be made for comparison showing the economic yield of any given area of water. A number of suggestions are made as to possible improvements of the machine, but great stress is laid upon the centrifugal method.

In closing, Dr. Field suggests that such means may be valuable for collecting the microscopic plants and animals which constitute the food of the just hatched fry of so many species of fish, thus increasing the efficiency of the methods of artificial propagation of food fishes.

The Old Tide Mills of Brooklyn.

It will be of interest to many New Yorkers, and will possibly be news to some, to know that within the boundaries of the greater city, and within the limits of the Borough of Brooklyn, there still exist landmarks of bygone times and industries, in a good state of preservation, and dating back to the early Dutch colonial period. Among these are the grist mills, three of which yet stand, all of them still in working order. A word or two concerning their origin will perhaps prove interesting.

The earliest settlers in Brooklyn, pushing their explorations through the densely wooded heights near the river and beyond the forest-covered hills now occupied by Prospect Park, found in the level and comparatively treeless stretches of arable land beyond Flatbush a region reminding them of their native Holland, requiring but little labor to prepare it for the production of crops.

Ancient records show that the first land on Long Island to be occupied under a grant from the authorities of New Amsterdam was in and near the present village of Flatlands.

To quote from Stiles' History of Brooklyn: "In June, 1636, Jacob Van Corlaer purchased from the Indians a flat of land, and, on the same day, Andries Hudde and Wolfert Gerrittsen purchased the flats west of Corlaer's. These purchases were confirmed by a grant from the director, Wouter Van Tweller. The owners at once commenced planting, and the place became in time the village of Amersfoort, or Flatlands."

The erection of mills for grinding their grain became necessary, and, of the earlier structures, the three mentioned remain. They are all similar in type and are operated by the rise and fall of the tides. The construction of a dam and water gate on one of the many creeks emptying into Jamaica Bay, with a short sluiceway to divert the waters to the mill wheel, was a simple operation, and was the means resorted to. As the tide rose, the open gate allowed the water to accumulate above the dam, and with the closing of the gate just before the ebb, the stream passing through the sluiceway operated the large undershot wheel, and thus furnished a steady and reliable source of power during each ebb tide.

A visit to one or the other of these old tide mills will prove of interest. The oldest is situated on Garrettson's Creek, on land forming part of the original Gerrittsen grant in 1636, and was built not long after the first settlement. It may be reached by the Kings County elevated road (Brighton Beach trains), stopping at Neck Road station and walking (or wheeling) eastward along the Neck Road about one mile to the shore of the creek. The rough-hewn timbers and weather-stained clapboards are in excellent preservation and bid fair to last for years, unless the iron hand of improvement decrees demolition. The wheel and the primitive machinery inside the mill are in good condition and capable of doing effective work.

The same may be said of the Vanderveer mill, near Canarsie, which stands beside the creek emptying into Canarsie Bay, and may be seen by the excursionist on the train from East New York, just after crossing the creek midway between the points mentioned and about five hundred yards to the left of the track. This old structure is still used by the Vanderveer family, descendants of the first settlers, on whose farm it is located.

The third mill is found on Spring Creek, at the end of Montauk Avenue, Twenty-sixth Ward (station on Kings County elevated railroad), and while of later construction than the others, still dates back to ante-revolutionary times. It has a more modern exterior than the others, having been frequently repaired, but the timbers and the old-fashioned machinery are those of the original mill. This is also in working order and is still used by the farmers of the neighborhood. A quaint and picturesque hamlet of fishermen's boat houses has grown up along the banks of the creek and furnishes a wealth of interesting material for the artist and the camerist.

The opportunity of conveniently reaching and studying structures like these, suggestive as they are of the primitive times of the Hollander colonist, and their contrast to the nearby rush and bustle of the metropolis, is one not frequently afforded the city resident, and will repay one well for the time occupied in visiting them.

Death of Baron Lyon Playfair.

Baron Lyon Playfair, chemist, political economist, civil service reformer and parliamentarian, died in London, May 29.

The late Lord Playfair was born at Meerut, Bengal, India, in 1819. He was educated at the University of St. Andrew's and at a very early age took a special interest in the study of chemistry. After studying this science at Glasgow and Giessen, he was appointed, in 1843, Professor of Chemistry in the Royal Institution at Manchester. In the following year he was appointed on the commission to examine into the sanitary condition of towns and populous districts of England. After this service he was appointed chemist to the Museum of Practical Geology at London. In the great Exhibition of 1851-52 he was special Commissioner in charge of the Departments of Juries. In 1856 he became Superintendent-General of the Government Museums and Schools of Science and in the following year he was elected President of the Chemical Society of London. In 1858 he became Professor of Chemistry at Edinburgh University, and among his pupils was the Prince of Wales. He examined, in conjunction with Sir Henry de la Beche, the availability of the coals of the United Kingdom for the purposes of the navy and into the cause of accidents in mines. In 1847 he was President of the Civil Service Inquiry Commission and he sat several times in Parliament. He was a member of many learned societies and held numerous British and foreign orders. His scientific memoirs were considerable in number and importance and he also wrote on economical questions.

Men of Science as Regulars.

When the brigade of engineers, United States Volunteers, is commissioned, it will have among its ranks scientists, electricians, civil, mechanical and topographical engineers of national repute, including college professors and men prominent in the commercial world. A sufficient number of men have been procured for the first regiment, and other regiments are well advanced. Col. Gillespie, of the Corps of Engineers, U. S. A., will probably command the brigade. Col. Eugene Griffin, who is vice-president of the General Electric Company, with whom the idea of forming a volunteer engineering corps originated, will be colonel of the first regiment. Among the distinguished recruits are William B. Parsons, chief engineer of the Rapid Transit Commission of New York City; Dr. L. Duncan, professor of electrical engineering in Johns Hopkins University; Eugene Ellicott, secretary of the University of Pennsylvania and topographical and hydrographical engineer of the United States Coast Survey for a year. The men who have associated with Col. Griffin in organizing the regiment and who will probably be among its officers are Capt. G. W. Bramwell, W. G. Ramsay, F. M. Barstow, J. A. Steinmetz, Walter Abbott, general manager American Projectile Company, Lieuts. Rodman and Walke, explosive experts, and others. Men will be taken from every branch of mechanical skill. There will be engineers, blacksmiths, machinists, electricians, telegraphers, photographers, carpenters, railroad men and those skilled in the use of explosives, in the corps. It is expected that nearly all of the railroads and bridges in Cuba will be destroyed by Blanco's troops before the approach of our army of invasion, making plenty of work for the engineers.

Electricity at the Paris Exposition.

American electrical machinery manufacturers are to have the opportunity to furnish the Paris Exposition with electrical machinery to the value of $1,000,000. This opportunity is the result of efforts exerted by the special American commission sent to Paris to look over the ground and furnish advice regarding the American display there. Commissioner Hamburger, who has just returned to New York, said that it is evident that the French government desires to cultivate the friendliest relations with America, and an opportunity has again been given to our electricians to furnish electrical machinery to the amount mentioned above. A chance was formerly given American electricians to furnish electrical machinery, but, because of the absence of information, the American manufacturers did not respond quickly enough. Negotiations were then begun with manufacturers of other countries, and as far as America was concerned the matter seemed to be closed. This new contract will be awarded, notwithstanding the fact that, while Germany and Russia have each appropriated $1,250,000 to defray the expenses of a display, and England has appropriated $500,000, this country has not as yet voted any sum for the national exhibit or even appointed a permanent commission. It is said that the $1,000,000 worth of machinery would be equivalent to 40,000 electrical horse power, and this machinery would be a display and also prove a profitable transaction.

Fatigue in Reading.

The Psychological Review contains an article, "On the Conditions of Fatigue in Reading," which is of some practical importance, as well as of theoretical interest. The authors, Messrs. Harold Griffing and Shepherd J. Franz, of Columbia, following the idea suggested by Prof. Cattell in a well known paper, and supplementing his work, show how facility of reading is affected by size and quality of type, by "leading," by the intensity and quality of the illumination and by the quality of the paper. The result to which they come is that "the size of the type is the all-important condition of visual fatigue. No type less than 1·5 mm. in height (eleventh point) should ever be used, the fatigue increasing rapidly even before the size becomes as small as this." The intensity of illumination is "of little consequence within the limits of daylight in well lighted rooms. Very few intensities less than 3 to 10 candle-meters (a candle-meter being the light of a standard candle at a perpendicular distance of one meter) are sources of even greater fatigue than small type, and 100 candle-meters may be considered a type limit." The experiments on the relative legibility of different kinds of type were carried out by different methods, the results of which agree fairly well—by determining the times of reading certain passages, by finding the percentage of words which could be seen in certain phrases when cards containing them are exposed for a given time, by determining (through the falling chronometer) the time of exposure necessary for reading certain words in different type, or the amount of illumination necessary to see letters of different sizes. The experiments are of a careful character. But it would have been well in determining the effect of these various conditions to try a parallel series with nonsense words instead of real ones, so as to eliminate the element of familiarity, and the various accidental elements arising from special association, though this has been done in part by taking a considerable number of observers.

The Opening of the Omaha Exposition.

The Omaha Exposition opened on June 1, in the presence of 100,000 visitors. At 9.30 o'clock the parade started from the center of the city to the grounds. The Marine Band from Washington was there, and a hundred musical organizations from the various States of the Middle West contributed to the occasion. The parade was three miles long, consisting of officers and guests of the exposition in carriages and the semi-military organizations of all the great cities of Nebraska and adjacent cities. Rev. Dr. Nichols, of St. Louis, opened the exercises at the ground with prayer. President G. W. Wattles, John L. Webster, of Omaha, and John L. Baldwin, of Council Bluffs, made addresses. President McKinley then touched a button in the telegraph room at the White House, thus setting in motion the machinery of the Omaha Exposition.

Coast Signal Service.

The Coast Signal Service is now in operation from West Quoddy Head, Me., to the Mexican border, all the stations being connected by wire with the Navy Department. This service has the co-operation of the Lighthouse Service, Life Saving Service and Weather Bureau. Vessels passing any of the stations are required to signal by international code any news they may have of Spanish craft which they may have sighted at sea. Any precautionary news, such as an enemy within the waters of the United States, will be duly communicated to the vessels. Stations are at all the prominent points on the coast and may be known by the signals hoisted on a ninety-foot signal mast. Most of the permanent lighthouses, as well as the life saving stations, have telephonic connections with the coast signal stations and are equipped with international code flags and books.

THE German press is presenting a very different attitude in regard to the war than was attributed to it some weeks ago. Many of the most prominent journals have come out boldly advocating the justice and necessity of the course taken by the United States. In a recent issue of the Hanover Courier the following significant words may be found: "Nobody can find a reason for disturbing the friendship existing between the United States and Germany on account of the fact that this government is bringing to final execution the fall of a state which has become completely rotten through its own misdeeds extending through centuries, and it can only be considered as a happy accident in history that the part of executioner has fallen upon the United States."

IN the village of Saasen, Shepherd Johannes Stende and his wife are celebrating their diamond wedding in great bodily vigor amid the general rejoicing of the community. The husband is 90 years of age and the wife 83. The Emperor generously ordered a present of 30 marks (about $7.50) to be given to them.

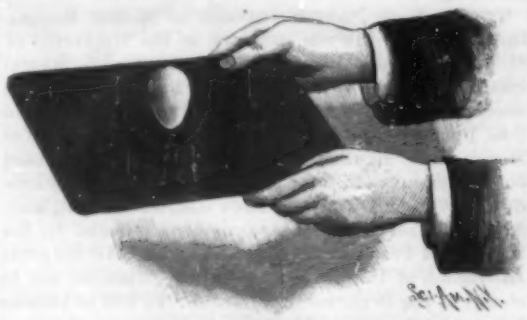
EGG AND POTATO TRICK.

For some reason or other jugglers have always been very fond of egg tricks, and in the repertoire of many of them, the egg takes an important position. Few laymen know that it is impossible to balance a raw egg. Jugglers use hard-boiled eggs, which are spun on their small ends on shallow japanned trays. If the tray is kept gently moving in a small circle in the opposite direction to that in which the egg is spinning, the latter will continue to spin as long as desired.

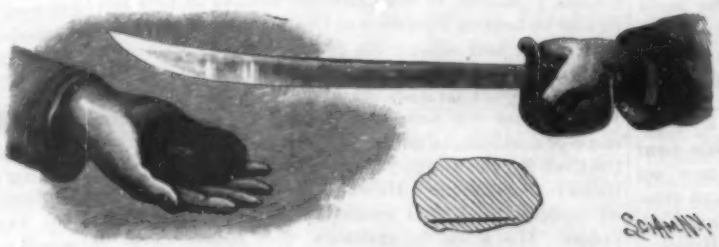
A fitting finale to any juggling act is to place a potato on the hand of an assistant and cut the potato in two with a sharp sword without leaving any mark upon the skin. A second potato is often cut on the neck of the assistant.

Among the several medium sized sound potatoes on a tray are placed two potatoes prepared as follows: Insert a needle crosswise of the potato near the bottom. After showing the sword to be really sharp, by cutting paper and slicing one or two of the potatoes, the performer picks up one of the prepared potatoes and places it on the assistant's hand; but apparently it does not lie to suit him, so he slices off one side of it, using care to cut away the side just under the needle and as close to it as possible, then places the potato once again on the assistant's hand. After making a few flourishes with the sword, he cuts through the potato, dividing it in half.

In striking the potato with the sword he makes sure that the sword will come exactly crosswise on the needle; consequently, when the sword reaches the needle it can go no farther, and the brittle nature of the potato will cause it to fall apart, the very thin portion below the needle offering no resistance to the separation. The second potato is then cut in the same manner on the assistant's neck. There are many other false juggling tricks, but the above will suffice to show that "there are tricks in all trades but yours."



SPINNING AN EGG.



CUTTING A POTATO ON THE HAND.

STEEL WIRE GUNS.

It was along about 1850 that Mr. Woodbridge first presented an iron gun wound with steel wire to the American government. The object that the inventor had in view was to reinforce cannon and, consequently, permit of the use of higher internal pressures. But this first tentative was unsuccessful, since certain arrangements, such as the welding of the wires together and the tension given them, were followed by poor results.

Five years later Mr. Longridge experimented in England with a gun based upon the same principles, and which may be regarded as the first steel wire cannon. The same study was undertaken in France, between 1871 and 1880, by Capt. Schultz, and then abandoned.

At present everybody is in accord in recognizing the advantages of this mode of construction, as far as the resistance of the piece is concerned, and for the last few years England has not hesitated to render such system of artillery reglementary. Its entire new fleet is provided with it. It is even surprising that it delayed entering upon the manufacture of such guns so long. The reason was that it was claimed for a long time that steel wire cannon were wanting in longitudinal resistance. This sort of prejudice was due to the results furnished by the first guns of the kind, which were composed of a simple bronze tube wound with several layers of wire. Under such circumstances, the longitudinal resistance was feeble, and the guarantees of safety and duration were insufficient.

Subsequently, the use of a jacket carrying the breech block and trunnions has dispelled every doubt that this new artillery could give rise to.

Mr. Longridge, continually improving his processes of manufacture, has finally produced a powerful gun that is capable of withstanding in the chamber pressures that amount to nearly 5,000 kilogrammes to the square centimeter.

In No. 1 of the accompanying figure, from La Nature, is represented an English rapid-fire regulation piece of 152 mm. of the Longridge model. Its length is 6·3 meters—say about 41 calibers. It consists of a bored steel tube of 152 mm. diameter, upon the back part of which is shrunk a second steel tube, around which are wound several layers of steel ribbon 6 mm. wide and 1·5 mm. thick. The resistance of these ribbons to rupture is comprised between 140 and 150 kilogrammes per square millimeter of section. Their tension is regulated by special machines. Over the ribbons is fixed the jacket, designed, as we have stated, to assure longitudinal resistance.

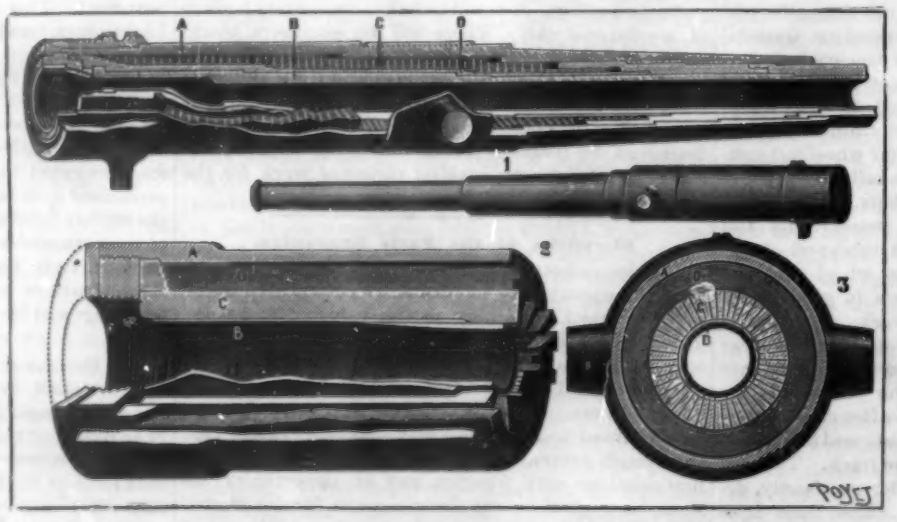
In the construction of steel wire guns, England has been followed by the United States. Mr. Brown, who is well known on the other side of the Atlantic through his remarkable work upon artillery, proposed to the war department of the United States a system of cannon in which the ordinary steel hoops were replaced by windings of wire. One of the peculiarities of this gun consists in the replacing of the second steel tube of the Longridge piece by a series of jointed segments that unite with each other upon a thin steel tube. This latter constitutes the chamber of the gun and is provided with the grooves that give the projectile its rotary motion.

According to Mr. Brown, the advantages presented by this new gun reside especially in the use of materials, such as segments, wire, etc., of small dimensions, the material to be given the highest possible qualities of resistance, and ensures very perfect results.

The manufacture of the new piece is relatively simple. The longitudinal segments are assembled as shown in Figs. 2 and 3, and the two extremities of the tube thus formed receive a ring. The whole is then turned upon a lathe in such a way as to give it the proper dimensions, and form upon the external surface a series of steps of which the height is precisely equal to the thickness of the steel wire designed to form a hoop.

These wires have a square section of 3·5 mm. They are wound successively over each step and alternately in one direction and the other, the proper tension being given them by a special machine. After the winding is finished, the gun is heated, and there is introduced into the interior a thin steel rifled tube.

The jacket that carries the breech block and trunnions assures the longitudinal resistance, as in the English pieces. Such resistance is further increased by the arrangement adopted for the winding of the wires.



1. English Regulation Gun of 152 Millimeters Caliber: A, jacket; B, internal tube; C, steel ribbons; D, second tube.
2 and 3. Sections of the Brown Gun: A, jacket; B, internal tube; C, segments; D, steel wires.

Mr. Brown made his first experiments with a 25 mm. gun. As the results were favorable, he constructed upon the same principle a piece of 127 mm. caliber and 5,300 kg. weight. The tests of this, which were made under the supervision of the United States war department, were very remarkable, and the piece showed an unprecedented resistance.

A second gun of the same caliber, presented by the inventor, was experimented with in 1893 at Sandy Hook. It was put out of service after 216 shots by the splitting of the internal tube, and after there had been developed in the chamber a pressure reaching 5,800 kilogrammes to the square centimeter.

The experiments have, therefore, fully decided in the inventor's favor. The only difficulty consists in the selection and arrangement of the internal tube, which, in the experiments, exhibited a slight weakness. This has not prevented the United States government from deciding upon the construction of a Brown gun of 250 millimeters caliber.

The length of the wire designed for the winding will be about 120 kilometers. Upon the English guns of 305 millimeter caliber, the length reaches 160 kilometers. Mr. Brown estimates that the initial velocity will be from 900 to 930 meters per second. If the experiment proves a success, the Americans will possess a gun that will be greatly superior to any of those now employed in the various European navies, and, with their habitual spirit of decision, they will doubtless make a transformation in their present armament, which leaves much to be desired.

The Waste of Shipping.

Lloyds Register keeps us informed as to the waste of shipping. There are many causes which lead to vessels being removed from the register. Most of them are painful to contemplate, since they involve danger to life, while one gives cause for satisfaction. A certain number of vessels are broken up or condemned, and it would be well if this number were greatly increased, since it would reduce the loss under other heads. It is not often that the well-found ship appears in these returns under the headings of "Abandoned at Sea," "Foundered," "Lost or missing." The experience of the Atlantic companies has shown that a ship can be rendered almost as safe as a house on shore by a liberal expenditure of money and by increasing vigilance on the part of the captain and crew. It is the ship on which undue economy is exercised that usually falls a prey to bad weather.

The period of July 1 to September 30, 1897, was not marked by any excessive amount of casualties. During that time 176 vessels, or 137,286 tons, were removed from the register in various ways. This compares favorably with the same period in 1896, when 211 vessels, or 162,724 tons, were removed. It is, however, slightly over the average for the past decade. There is improvement under every heading, as compared with the same quarter of last year, except under "Wrecked," and this increase seems to be due to the larger size of the vessels, and not to an augmented number of casualties.

In the third quarter of 1896 there were 96 vessels, or 62,763 tons, wrecked, against 80 vessels, or 68,882 tons, in 1897.

Of vessels owned in the United Kingdom, there were 21 lost in this way in each quarter, but in 1896, 33,000 tons. There were 42 vessels, or 35,325 tons, broken up, condemned, etc., in the period under review, against 39 vessels, or 47,640 tons, last year. The vessels which foundered seemed to have been generally of small size, and only two, totaling 454 tons, were owned in the United Kingdom.

When we begin to discriminate between steam and sailing craft, we find that it is the former that accounts for the major portion of the tonnage lost, while the latter swells the number of vessels lost, the vessels being: Steam, 57 vessels, of 84,681 tons gross; sailing, 119 vessels, of 52,606 tons net. During the quarter there was not a single steamer posted as "Burned," "Lost," or "Missing," and only two were abandoned at sea. As against this, there were 11 sailing ships abandoned, six burned, one lost, and four missing. Of vessels owned in the United Kingdom, 0·044 per cent of steam were removed, and 0·057 per cent or sailing vessels, a fact that a timid voyager may well note. The disparity of these figures would be increased still further if vessels broken up were not included. If we were to judge by the tables, the safest ship to go to sea in is a Swedish steamer, since only 0·018 per cent of the vessels under that flag were lost in the quarter. This high figure of safety is not always maintained, but, nevertheless, Swedish steam vessels have an excellent record. Their sailing craft do not do so well, but then many of them are engaged in the timber trade, and any leaky tub is considered good enough for that.

WHAT struck a Fiume, Austria, warehouse and set it on fire turns out to have been a meteor. It was assumed to have been lightning till a four-ton meteoric stone was found in a deep hole in the cellar.

A NEW LIFEBOAT.

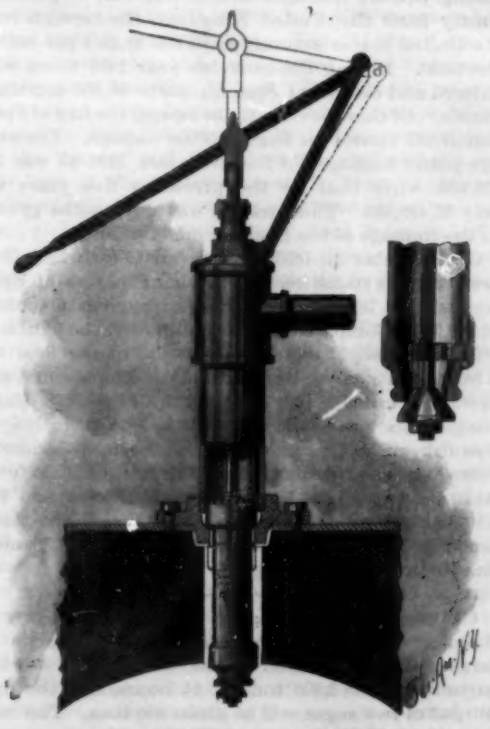
The accompanying illustration represents a novel lifeboat which has been devised and patented by James Mitchell, Sr., of Arrow River, Manitoba, Canada. In general form the boat is cigar shaped, tapering from the middle to both ends, and is constructed either of metal or wood. The boat pictured in the engraving is formed of wooden staves, surrounded by hoops and strengthened from within by stout ribs. A large conical block at each end of the boat is provided with a passage or rope guideway, whose ends are at right angles to each other. A rope passes through these guideways, extends through the whole length of the boat and is attached to a ship by the usual means. Within the body of each conical block and intersecting each rope guideway is a recess containing a spring-pressed block. When the rope is removed, the block is automatically forced down so as to prevent the entrance of water. Should it be impossible to lower the boat in the ordinary way by letting out the suspending rope, it may be launched upon an even keel by severing the rope from within.

A NEW LIFEBOAT.

Hatchways for the entrance and exit of passengers, a rudder, and steering ropes operated from the hatchways or from within the boat, are all provided. A heavy keel gives the boat stability and rights it, should it be overturned. Ventilating pipes are provided which can be closed by valves to prevent the entrance of water.

A NOVEL SPRAYING DEVICE FOR CARBURETERS.

In using spraying devices for the introduction of oil and hydrocarbons as fuel, it frequently occurs that the intense heat to which the nozzles are subjected causes them to burn out. New nozzles must then be substituted, necessitating the loss of much time and causing considerable expense. To avoid these inconveniences, Mr. George H. Weeks, of No. 412 East One Hundred and Twentieth Street, New York city, has patented a spraying device in which the nozzle is withdrawn from the heated chamber when not in use. Referring to our illustration, it is seen that the spraying device is provided with a protective casing fixed to the walls of the carbureter and screwing into a plate, whose inner surface constitutes a valve-seat. Within the casing a movable cylinder is fitted and provided with a perforated cap, through which oil may pass. The inner edge of the cap forms a valve adapted to engage the valve-seat mentioned previously, so as to prevent the oil from flowing around the cylinder. To the other end of the cylinder another cap is threaded, which forms the head of the nozzle. Into the outer end of this cap an adjustable cone screws, by means of which the size of the spray may be regulated. To the perforated cap upon the inner end of the cylinder a rod is attached which extends through the casing and is pivoted to a lever fulcrumed upon a link. As soon as the spraying is discontinued, the nozzle is withdrawn from the immediate action of the heat merely by operating the lever. In manufacturing illuminating gases, spraying devices of this character would be exceedingly useful, preventing, as they do, the rapid burning out of nozzles and obviating the necessity of frequently substituting new ones for those which have been destroyed.



A SPRAYING DEVICE FOR CARBURETERS.

The Heat of the Incandescent Electric Lamp.

The incandescent electric lamp is essentially a device which transforms electricity partly into light but mostly into heat, says The London Lancet. As is well known, the carbon filament of the lamp is a substance offering great resistance to the passage of the current, and the product of this resistance is light and heat. It is an instance of the translation of one form of energy into another. It may not, however, generally be known that the light produced is but after all only a small percentage of the energy thus manifested—some 5 or 6 per cent only at the most. This fact is very important, bearing in mind a very common notion that the electric incandescent lamp is free from the heat rays. It is true that the lamp when working is not comparable with a flame or naked light, but at the same time the heat evolved is such as may lead to ignition. We are disposed to emphasize this point because the incandescent electric lamp is used for the purposes of illumination and decoration in shops without any regard to the possibility, nay, probability, of fancy goods being fired which happen to be contiguous. Indeed, so firm is the idea that the incandescent electric lamp is free from heat that it is frequently to be found buried in a mass of easily ignited and highly inflammable material. This is a mistake, and care should be exercised with the electric lamp in its application in this connection, but the risk, of course, is not so great as where naked lights are employed. We have found by experiment that on immersing a 16 candle power lamp (100 volts pressure) in half a pint of water, the water boils within an hour and in proportionately less time when a 32 candle power lamp is substituted. If again the lamp be buried in cotton-wool, the wool soon begins to scorch and ultimately to burst into flame. In one experiment which we tried, the bursting into flame of the wool was accompanied by a loud report, due to the implosion of the lamp. It clearly appears from this that the incandescent electric lamp cannot be regarded as an unlikely means of starting a serious fire, and shopkeepers, especially those who exhibit highly inflammable fabrics, should know that there is risk in placing such goods too close to the lamp. The lamp in contact with celluloid fires it in less than five minutes, and therefore the danger is particularly obvious in the case of toy shops, where electric incandescent lamps are often suspended in the midst of toy celluloid balls.

Too Poor to be Economical.

Several leading Americans who have been seeking to place contracts in this country, says the English Iron and Coal Trades Review, both for labor-saving machines and for other American notions of merit, have informed me that they are surprised to find how generally the complaint is made that our manufacturers are too poor to be able to afford the luxury of more economical methods and appliances. In a number of cases this is known to be the case, but it seems to be more largely the fact than most people anticipated. And yet it is not so surprising after all. The majority of the large concerns engaged in the iron and steel industries of this country are limited liability companies, and it rarely happens that limited companies are allowed by their shareholders to provide as large a reserve as they ought to do in order to meet all emergencies. In many cases almost the last sixpence has been paid out in dividends, and repairs and renewals are inadequately provided for. In some industries this might not be a matter of much concern. In the iron and steel industries it counts for a great deal. The truth is that, as history has been lately made in these industries, it has almost been necessary to completely reconstruct mills, forges, and other plant, every ten years, so that any plant kept in use for a longer period has become more or less antiquated. Our American friends appear to have realized this condition more fully than ourselves, and when they find that a plant is no longer up to date they make no fuss about removing and replacing it. It is their readiness in this respect that has brought them to the front; it is our backwardness in the same essential that has left us in many cases lagging behind.

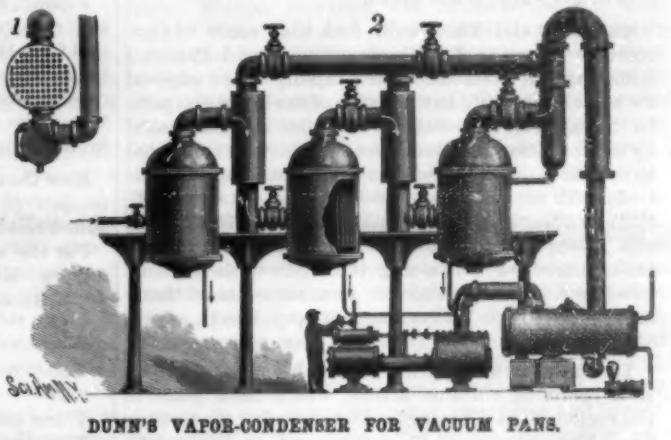
Patterns and Models.

It has been decided by the Board of United States General Appraisers that "dress patterns are not models of invention." A case was brought before the board in which it was claimed that an importation of muslin dress patterns, made up and stiffened to show the effect of the garment, ought to be exempt from duty under the provision of the law bearing upon "models of invention and other improvements in the arts." General Appraiser Wilkinson affirms that, while it may be fairly assumed that a pattern is a model, and that dressmaking is an art, the question to be determined is whether a change of fashion in dress is an invention or improvement in the arts within the contemplation of the statute. In rendering judgment in the case he says:

"There are various devices in wearing apparel that are patented, such as skirt supporters and glove fasteners, and these would be inventions within the meaning of the law; but a change from a tight to a balloon sleeve and from a full to a narrow skirt are not patentable inventions, and only a vivid imagination could discover an improvement in the arts in the continual ebb and flow in the tide of fashion. We find that the goods are not models of inventions or of improvements in the arts."

A SIMPLIFIED VAPOR-CONDENSER FOR VACUUM PANS.

In the apparatus now generally used for condensing the vapors of sugar juices, some loss is occasioned by the vapors coming into contact with the water used for condensation. An improved apparatus for condensing these vapors without loss and without the use of any complex devices has been devised and patented by W. and A. W. Dunn, of Honolulu, Hawaiian Islands. The apparatus is provided with the usual vacuum pans, each connected by a valved pipe to a separator. Each separator is in turn connected with the next vacuum pan; and from the last separator a pipe leads to the bottom of a surface condenser containing a coil of pipe connected at its ends with water supply and water discharge pipes. The condenser is furthermore connected to a vacuum pump which draws the vapors from the vacuum pans and separators down through the condenser and around the coil of pipe. By this arrangement the vapors of sugar are condensed without direct contact with the water, the apparatus differing in this respect from the usual vacuum condensers. The products of condensation flow into a reservoir, from which they are pumped to a tank to be further treated. The drums of the vacuum pans are connected to the pipe of the vacuum pump, so that the discharge from the drums passes through the vacuum pump with the vapors.



DUNN'S VAPOR-CONDENSER FOR VACUUM PANS.

Reasons Why We Underdrain.

It is, explains The Drainage Journal:

To get the excess of water out of the soil.

To prevent the surface washing of the soil.

To save the humus of the soil.

To save the fine particles of the soil.

To save the fertility brought up by the capillary action of the soil.

To save the fertility brought down out of the air by rainfall to the soil.

A drained soil is ready for the plow several days in advance of the soil not drained.

A drained soil is eight or ten degrees warmer and is more easily made ready for the seed.

Is deeper, allowing the feeding roots to penetrate as deep as the tile are laid for food and moisture.

A drained soil is ready to cultivate sooner after a rainfall.

A drained soil is less injuriously affected by wet or dry weather.

Crops on a drained soil have a longer season for maturity.

A well underdrained soil will increase the crop productions from 10 to 50 per cent—sometimes more.

A drained soil is in the best possible condition to grow maximum crops with intelligent husbandry.

Science Notes.

M. Charlois, the French astronomer at the Nice observatory, has discovered two new asteroids. The number of these small planets is now 434, of which 158 have been discovered by Frenchmen, 70 by Americans and 64 by Germans.—La Vie Scientifique.

The projection of lantern slides so that they appear in stereoscopic relief has been made possible by an ingenious device in which a slotted disk rotates rapidly before two lanterns. The views are thus presented on the screen in rapid alternation, while the observer looks through other slots cut on the rim of the disk. In this way the right eye can see only the picture from the right lantern and the left eye that from the lantern on the left; so that, if a sufficiently rapid rotation occurs, there is a stereoscopic effect without any perceptible flicker.

The first volume of the catalogue of the Bibliothèque Nationale, of Paris, France, has just been published. This catalogue contains only printed books. The Bibliothèque Nationale, founded in 1645 with 1820 volumes, now embraces nearly 3,000,000 of them. Among the subjects fully catalogued, the following ones are most prominent. French history, 279,048 volumes; law, 144,868 volumes; plays issued separately, 116,864 volumes; philosophy, 97,456 volumes; catholic theology, 74,332 volumes; French poetry, 68,841 volumes; and history of foreign nations, 61,929 volumes. —Le Droit d'Auteur.

There are a few of the comparatively higher animals which live in hot springs, but these are chiefly mollusks. Until the present year the only instance of the occurrence of the isopad crustacea in warm springs was that of Sphæroma dugesi, found living in this situation in northern Mexico. During the past year, however, Harriet Richardson has described in the "Proceedings" of the United States National Museum another species (S. thermophilum), found by Prof. Cockerell living in a warm spring a few miles west of Socorro, New Mexico. Unfortunately, the temperature of the water is not given.

Maldeney and Thouvenin find that seeds of Convolvulus arvensis, Lepidium sativum and Panicum miliaceum all germinate more rapidly when exposed for a few hours daily to the action of the Roentgen rays. In the experiments, electrical influence was eliminated by using a sheet of aluminum which was connected to the earth as a screen between the lamp and the seeds. No notable rise of temperature, not even sufficient to affect a pair of thermoelectric needles attached to a Thompson's galvanometer, was observed after exposing the earth containing the seeds to the rays for two hours. The influence on germination must therefore be due to the X rays alone.—Comp. Rend., cxxvi., 549.

The carbonic acid spring in Sondra is looked upon as a result of volcanic action, which took place in the region of the Thuringian Forest during the tertiary age. The pressure of 17 atmospheres at the mouth has never diminished and the supply of acid seems to be unlimited. When the opening is closed by means of a system of valves, the gas is used as a source of power for an illuminating plant and for the machinery used in liquefying the acid. The spring yields about 1,000 cubic yards of the gas per hour. As it issues from the earth it contains 99 per cent of carbon dioxide, the remainder being nitrogen, which is removed by passing the mixed gases into water under high pressure, displacing the nitrogen with pure carbonic acid and liberating the purified gas under low pressure. The capacity of liquid carbon dioxide of this plant is over ten tons in twenty-four hours.—Südd. Ap. Ztg.

Prof. C. A. Doremus has lectured before the American Chemical Society on the chemical examination of writing fluids, describing their behavior on heating or on applying reagents. Of the sympathetic inks, the color of which is developed by heat, those containing a cobalt salt become blue, while a nickel salt turns green and onion juice brown. Lead acetate in ink is blackened by hydrogen sulphide, a copper salt gives a brown with potassium ferrocyanide, and a mercuric salt reacts with very dilute potassium iodide solution, forming a red precipitate. Potassium ferrocyanide yields a blue coloration with ferric chloride, tannin a violet black with the same reagent, pyrocatechin turns green with iron salts, and dimethaniline becomes violet in the presence of chromic acid. Among other constituents of inks, eosine produces an orange-yellow color with hydrochloric acid, while corallin turns yellowish with the acid and red with alkaline β naphthol. Amine turns yellow with hydrochloric acid (original color with β naphthol), safranine blue, chrysaniline yellow (purplish-red with β naphthol), carmine has its intensity reduced, and fuchsine is bleached (red with β naphthol). Logwood ink darkens to purple with sodium nitrite, is bleached by hydrochloric acid, and its color is restored by β naphthol. Brazil wood turns darker red with the nitrite, is not affected by the acid, but becomes reddish-purple with β naphthol.—Amer. Drug.

Miscellaneous Notes and Receipts.

Platinizing Fine Copper and Brass Ware.—800 grammes of sal-ammoniac and 10 grammes of platinum-sal-ammoniac are heated to the boiling point with 400 grammes of water in a porcelain dish and the articles to be platinized are placed in it, whereby they soon become covered with a coating of platinum. They are then removed from the liquid, dried and polished with whiting.—Handelszeitung f. d. Gold und Silber Industrie.

Silver-plating Tin.—Prepare a solution of 3 grammes of bismuth subnitrate in 10 c.cm. of nitric acid of 1·4 specific gravity, to which add a solution of 10 grammes of tartar and 40 grammes of hydrochloric acid in 1 liter of water. In the mixture of these solutions immerse the tin articles freed from grease and oxide. The pulverulent bismuth precipitated on the surface is rubbed off, whereupon the objects appear dark steel gray. For silvering prepare a mixture of 10 grammes of silver chloride, 30 grammes of cooking salt, 30 grammes of tartar and 100 grammes of powdered chalk, which is rubbed in a slightly moist state on the bismuth surface of the tin articles, using a flannel rag. The silver separates only in a very thin layer and must be protected against power and light before tarnishing by a coating of preservatives or celluloid varnish.—Zentralzeitung fuer Optik und Mechanik.

Uses of Borax.—We have reported before that an addition of borax to the starch or flour will enhance the adhesive quality of paste fifty per cent; borax also has an antiseptic action, and a slight admixture of it will prevent the paste from souring. For aquarelle painting, a varnish soluble in water may be prepared from five parts of shellac and one part borax, which is to be used for binder instead of glue.

With caseine, which is freshly precipitated from milk by the use of acetic acid, a liquid of thickish consistency is obtained by dissolving same in a concentrated borax solution. The substance possesses great gluing qualities, and, when mixed with lime, furnishes very permanent colors.

Finally, borax plays an important part in soldering, as it removes the oxide generated by the hot soldering tool from the solder, zinc or hard solder, thus assisting the soldering. In smearing up an iron stove with loam, a much more durable material is obtained by mixing four parts of loam with one part borax.—Condensed from the German (Illustrirte Maler Kalender for 1898).

New Ceramic Composition.—This composition mainly consists of asphalt, slate and graphite, to which are added residues of petroleum.

For the manufacture of slabs for paving, proceed as follows: Mix

12 kilos. of Trinity asphalt (purified).
10 " " finely powdered slate.
8 " " graphite.
2·50 " " petroleum waste.
25 " " asphalt powder.

These materials are mixed as follows:

The petroleum residue is heated in a kettle to 80° Centigrade, then the graphite is added and all is kneaded until the two substances are intimately mixed.

Now add the pulverized slate and knead without interruption until a homogeneous, dry mass of sandy appearance is obtained.

The purified Trinity asphalt, which has meanwhile been heated in a separate kettle and transformed into the liquid state, is then mixed with the obtained mass in the above described manner and kneaded with it until a substance presenting the appearance of caoutchouc is obtained. To this mass add finally the powdered asphalt and mix intimately by kneading.—Journal des Inventeurs.

Blotting Paper for Cleaning Machinery, etc.—For cleaning machines and parts of engines which are soiled by lubricating materials and dust while in use, fibrous substances, such as tow, woolen refuse, sponge cloths, jute waste, etc., are usually employed. The better varieties of cotton waste are sufficient for the clean scouring of parts of machines, but the cheaper ones are charged with dust, making the use of a sponge cloth necessary, which is specially manufactured for this purpose. Of late the use of blotting paper for scouring purposes has been recommended. Not only can the use of cotton waste be decreased, but also the sponge cloths become entirely superfluous. The workman formerly received on an average 250 grammes of cotton waste, one new sponge cloth and one or two washed ones per week; now he receives 150 grammes of cotton waste and eight to ten sheets of blotting paper. The former cost was 25 pfennigs (6¼ cents); now it is only 10 pfennigs (2½ cents). Hence the paper goes much farther than sponge cloths and woolen refuse, and as it cannot soil the machine with fibers and dust, it is decidedly preferable to cotton waste. Besides, the blotting paper is not so combustible as the other cleaning mediums. Another advantage of the paper over cotton waste is that in case it should get caught while cleaning parts of engines which are in motion, it tears easily and does not draw the hand of the workman into the works.—Journal der Goldschmiedekunst.

Spain's Foreign Trade.

Secretary Wilson, of the Agricultural Department, has authorized the publication of a bulletin on the subject of Spain's foreign trade from 1891 to 1895, inclusive, prepared by Frank H. Hitchcock, the chief of the section of foreign markets. The facts brought out are of particular interest at the present time. Two general matters are treated in detail in the publication, namely, Spanish commerce proper and shipping and navigation. The New York Tribune condenses the report as follows:

It is shown that, of the total tonnage transported to and from Spanish ports during the years 1891 to 1895 inclusive, 57·75 per cent was carried by merchantmen entered and cleared in the trade with the United Kingdom. France ranked second with 12·97 per cent of the total, and the Netherlands, with 8·52 per cent, stood third. The United States, with a record of 3·91 per cent, was the fourth country in importance; Belgium fifth, with 2·35 per cent, and Cuba next, with 2·34 per cent. Of the merchandise carried by vessels entered at Spanish ports during the years 1891 to 1895 inclusive, 56·54 per cent came from the United Kingdom. France furnished 9·43 per cent, Russia 6·80 per cent, and the United States 5·68 per cent. Of the goods carried by vessels cleared during 1891–95, the United Kingdom was the destination of 58·28 per cent. France received 14·48 per cent, the Netherlands 11·33 per cent, the United States 3·15 per cent, and Cuba 2·62 per cent.

Spain's commercial transactions with the rest of the world amount annually to more than $300,000,000. In 1895 the merchandise imports amounted to $161,829,516 and the exports to $153,353,759. The average value for 1891–95 was $315,077,440, as compared with $317,956,123 for the preceding five years. Spain's foreign trade is largely maritime. Of the merchandise imported and exported during 1891–95, only 15·9 per cent was transported by land, while 84·1 per cent was carried in seagoing vessels. During the earlier years of the decade, 1886–95, more than one-half of Spain's maritime commerce was carried by foreign vessels, but since 1891 there has been a change, and the national shipping is now in the ascendency. The imports and exports made under the Spanish flag during 1895 amounted to $146,969,806, and those under flags of other nations to only $115,145,676. Of the foreign commerce of Spain during 1891–95, about 70 per cent was transacted with four countries, namely, France, 31·11 per cent; the United Kingdom, 22·05 per cent; Cuba, 10·20 per cent; and the United States, 6·32 per cent. The total value of the merchandise annually exchanged between Spain and Cuba, Porto Rico, the Philippines, the Canaries and her various minor possessions exceeded $50,000,000.

The United States ranked third among the sources of Spain's import trade during 1891–95, furnishing 10·34 per cent of the value of such imports; Cuba came next with 4·46 per cent, while Porto Rico supplied 2·64 per cent. Of the merchandise exported from Spain during the same time, 34·41 per cent went to France, 23·32 per cent to the United Kingdom, 16·53 per cent to Cuba and 3·47 per cent to Porto Rico, while the United States came eighth in the list of countries to which Spanish exports were consigned. The average yearly value of the goods transported by Spain to and from France in Spanish vessels was $32,655,478, to and from Cuba in Spanish ships $32,064,536, the United Kingdom $27,069,104, Porto Rico $9,499,149, and the United States $9,302,723. Of the merchandise shipped from Spain in Spanish vessels, 36·77 per cent went to Cuba, 27·50 per cent to France, 7·72 per cent to Porto Rico.

Coal, which constitutes the most important item among Spain's non-agricultural imports, is procured chiefly from the United Kingdom, the receipts from the United States amounting to less than 1 per cent of the total. During the calendar year 1895 there were entered and cleared at Spanish ports 36,856 merchant vessels. Of these vessels, 19,169 carried the flag of Spain and 17,687 vessels the flags of other nations. The average yearly tonnage for the five years 1891–95 was 24,374,939, while that for the preceding five years was only 22,499,590. This increase was due to the growth in the tonnage of the Spanish merchantmen.

On December 31, 1895, the latest date for which there are available statistics, the merchant marine of Spain comprised 1,783 vessels, having an aggregate tonnage of 719,572. Compared with the statistics, the figures for 1895 show a slight increase in the size of the fleet and a rather marked one in its tonnage. The steam vessels increased from 431 in 1886 to 523 in 1895. It is shown that, for the five years from 1891 to 1895 inclusive, the Spanish shipping has carried on business somewhat more extensively from the customs districts along the Atlantic than from those on the Mediterranean Sea. The ships entered and cleared on the Atlantic amounted annually to 19,704, as against 15,738 along the Mediterranean.

CLAUS SPRECKELS' great beet sugar factory at Salinas, Cal., now nearing completion, will be the largest plant of its kind in the world. The working capacity will be 3,300 tons in 24 hours, and the daily output of raw sugar will be about 450 tons. The main building is 582 feet long and 102 feet wide.

COMMODORE SCHLEY'S RECONNAISSANCE OF SANTIAGO HARBOR.

Undoubtedly the chief center of interest in the Spanish-American war lies just at present in the harbor of Santiago de Cuba, and, judging from present indications, this is likely to be the seat of the most active and important operations for some time to come. The rumors of last week, to the effect that Admiral Cervera's fleet was "bottled up"—to use the pet phrase of the day—by our fleet were confirmed by an official dispatch from Commodore Schley. The fleet was identified on Sunday, May 29, by the unprotected cruiser "Marblehead," which, acting under the orders of Commodore Schley, ran in close to the Morro Castle, and steamed past the entrance to the harbor in a westerly direction. Her officers had a good view of the interior of the harbor as far as Punta Gorda. They saw four Spanish cruisers and two torpedo boat destroyers, together with the old "Reina Mercedes," lying behind the batteries between Smith Cay and Churruca Point. As soon as she had located the enemy, the "Marblehead" put out to sea and reported to the flagship. With a view of drawing the fire of the fortifications and locating the position of certain masked batteries which had recently been constructed near the entrance, Commodore Schley transferred his flag from the cruiser "Brooklyn" to the battleship "Massachusetts," and taking with him the "New Orleans" and "Iowa," he steamed within range of the enemy's guns.

The blockading fleet at this time consisted of the first-class battleships "Massachusetts" and "Iowa," the second-class battleship "Texas," the armored cruiser "Brooklyn," the protected cruiser "New Orleans," the unprotected cruiser "Marblehead," the gunboat "Castine," the auxiliary cruiser "Harvard," formerly the "Paris," and the converted yacht "Eagle." The "Brooklyn" and the "Texas" were lying several miles offshore taking on coal, and not far from them were the "Harvard," "Marblehead," "Castine" and the "Eagle." The "Massachusetts" led the way toward the forts, followed at about a cable's length by the "New Orleans," and the same distance astern of her was the "Iowa." Across the entrance to the harbor, and about 1,500 yards from its mouth, was Admiral Cervera's flagship, the "Christobal Colon," lying east and west, with her port broadside commanding the entrance. When the "Massachusetts" was about four or five thousand yards from the forts, she opened fire with an 8-inch gun in one of her port turrets and followed it immediately by a shot from one of the forward 13-inch guns. About eight seconds later the 1,100-pound shell struck not far from the bow of the "Christobal Colon." The Spaniards replied from the shore batteries and from the flagship. Three batteries opened fire, one from the west side of the harbor, another from the eastern side and a third from the island in the center. The "New Orleans" now came within range, using her 6-inch guns and smokeless powder.

The "Iowa" reserved its fire until it was directly broadside on the "Christobal Colon," when all four of the 12-inch guns, in the two turrets fore and aft, were turned loose. It seems that during the first round of our ships the fire on both sides was somewhat wild, the range proving difficult to ascertain because of the deceptive glare on the water, and it was not until the ships had turned and were passing in front of the batteries and entrance for the second time that effective work was done. By this time however both combatants had ascertained the distance, and the shooting by our men was remarkably good. The "Iowa" placed one shell directly under the "Christobal Colon" and apparently started a fire on board, which, however, seems to have been quickly extinguished. The "Colon," on the other hand, seems to have achieved some characteristically poor Spanish shooting. The batteries on shore did better work during the second passage of the American ships. Several shells fell dangerously near to the "Iowa" and the "New Orleans" and one near the bow of the "Massachusetts." These shots came from a large battery on the westward side of the harbor, and they were apparently fired from 10 and 12-inch Krupp guns. One large shell exploded directly above the "Iowa," but too high to do any damage to the ship.

After the firing had been in progress for half an hour, two batteries on the eastern side of the harbor were silenced, and a little later the island battery ceased firing. The large western battery and the "Christobal Colon," however, kept up a desultory fire for some twenty minutes after our ships ceased firing. Altogether the battle lasted fifty-five minutes, during which time our three ships passed twice across the line of batteries at the harbor entrance. Only the larger guns on the ships were employed, the "Massachusetts" using four 13-inch and eight 8-inch guns, the "New Orleans" her four 6-inch rapid-fire guns, illustrations of which were given in our issue of May 21, 1898, and the "Iowa" brought to bear four 12-inch and eight 8-inch rifles. The conflict was marked as far as our ships were concerned by a complete absence of casualties, not a single shell or fragment of shell, as far as can be learned, having reached the attacking fleet, for no damage was done to the ships beyond what was due to the concussion of the heavy guns.

Owing to the long range at which the bombardment was carried on, it was impossible to determine with any accuracy the amount of damage inflicted on the forts or on the flagship, but it is certain that the former suffered severely and it is probable that the flagship sustained more or less serious damage. Whenever the large 12 and 13-inch shells landed against the masonry of Morro Castle, it could be seen that huge masses of debris were thrown high in the air, and from the fact that Morro and two other forts were silenced, it seems probable that most of their guns were dismounted or otherwise disabled. The reconnaissance had the desired result of revealing the strength of the defense and locating the position of the masked batteries which it is known had been recently erected.

There can be no question as to the enormous natural strength of the position. The narrow channel and the lofty hills commanding it on either side make it an ideal harbor for defense and an extremely difficult position to reduce from the sea. It is evident that the entrance is commanded by powerful guns of the modern type, and unless the Spaniards have been as criminally negligent at Santiago as they were at Manila, it will be impossible for a hostile fleet to reach the inner harbor without first removing or exploding the mines which have been placed across the channel.

The dispatches mention the fact that the "New Orleans" proved to be very effective in this long range fighting, because her guns were using smokeless powder. Her gunners were able to watch the effect of every shot, and when once they had found the range, they were able to pour in a deadly fire with great rapidity. The Spanish forces appear to be well supplied with the new powder, and its use assists greatly in the concealment of gun positions, the slight haze or mist accompanying its discharge being quickly dissipated. It is safe to say that the complete equipment of our ships with smokeless powder will be one of the many indirect benefits conferred by the present war.

Portrait Statues in Egypt and America.

It is a singular fact, says The American Antiquarian, that from the earliest time there were portraits which accurately represent the forms and faces of individuals. Some of them were kings, others noblemen and a few private persons.

An unknown man of the fourth dynasty wrought out of a block of wood has been preserved. From this we learn the dress, the form and the face of the men who lived in that time, 2000 B. C. The dress was a simple tunic with a cord about the waist, a rude sword suspended from the cord, and a knotted staff is held in the left hand. All of it is very plain and simple, just as we would expect to see at this time.

Later on there are the portraits of the Hyksos kings. These have been described by Dr. A. H. Sayce. They are in great contrast to the statues just mentioned. They represent long, lank, lean faces, just such faces as we would expect to see in the Turanian or Mongolian races, with a long lock of hair falling on the shoulder, resembling the pigtail of the Chinese, but more resembling the scalp locks of the American Indians.

Still later there appears another set of portraits. They seem to belong to a superior race, and yet one which was allied or akin to the first race that reigned during the first four dynasties, who were the pyramid builders but not the builders of the temples. The portraits of the Pharaohs are also given in most books on Egyptology. Among them the most interesting was that of Rameses II. These were tall and stately kings, but they also show something of the royal air. Later on, we find as great a change in the portraits as we do in costumes and in the art and agriculture of Egypt. The faces now resemble the Babylonian and Assyrian kings, as they have heavy beards and full faces, and wear crowns or turbans. The hair falls in heavy folds below the crown. They seem to be well fed and are very complacent, and are in contrast to the warrior kings such as Rameses and others.

The age of Ptolemy brought in more luxury and ease, which are exhibited in the portraits as much as in the surroundings of the kings.

All the way through the history of Egypt there was a line of nobility, notwithstanding the changes and revolutions which occurred. There was evidently a progress in civilization, and this progress had much effect upon individuals, as upon the entire race, and marked its lines in their faces and forms as much as it did in their dress and equipage.

It is very interesting to trace this progress and study the history of Egypt and the East in the light of the portraits which have been preserved.

What shall we say about the early American history, that which preceded the advent of the white men and the date of the discovery? Can we learn anything from the portraits which have been preserved in the land?

We have in the preceding numbers spoken of the portrait columns of Uxmal Palenque, in Central America, and have maintained that they were the portraits of kings and queens. Some have thought differently, for they have held that they represent the divinities and culture, heroes and mere imaginary figures. A few, such as M. Le Plongeon, have held that they were portraits which resembled Egyptian faces, and have imagined from this fact and others a connection between Egypt and America in prehistoric times.

A close study of the portrait columns will reveal the error, for there is no resemblance whatever. There is, however, a lesson to be learned. These portraits are in great contrast to the pictures of the North American Indians, of which Blackhawk was a specimen. They must have belonged to different races, and represent a different line of descent.

"Starboard" and "Port."

The origin of the words "starboard" and "larboard," as used in the nautical vocabulary, has been attributed to the Italian words *questa borda*, meaning "this side," and *quella borda*, "that side," says Cassier's Magazine. Abbreviated, these two phrases appear as *sta borda* and *la borda*, and by corruption of languages were soon rendered "starboard" and "larboard" by British sailors. These two words sound so much alike that frequent errors and accidents occurred, and years ago, therefore, the use of "larboard" was discontinued and "port" was substituted.

A correspondent of this journal has made the point that the former term has been in use in the English language from a remote period, occurring in Anglo-Saxon as "stearboard," and in middle English as "stereboard," while in later times it was written "sterboard," from which it developed into its modern form "starboard." It originally meant, so our correspondent says, the board, or side, of the ship on which the man who steered it was placed. It may be called a native English word as distinguished from one of imported origin, and it possesses a special interest in its indication of the method of propelling and steering in vogue from very early times. The ancient mariner could run before the wind with his single square sail, but he could deviate only a few points on either side. Unless, therefore, the direction of the wind agreed with the course of the vessel, it was necessary for him to be in constant readiness to modify his direction by the help of the oar. The illustrations of early English manuscripts and the later figures of tapestries exemplify the old square rig, with auxiliary oars and steering from the side. In these examples one or more heavy oars are used at the bow and on one side only; while the course is kept by a steersman with a lighter, and often paddle-shaped, oar, worked near the stern, and invariably on the starboard side of the ship. This method of rowing survived until recent times, and was well shown on the coal "keels," which added so picturesque a feature to the navigation of the river Tyne. These vessels were managed by crews consisting of three men and a boy; they had a single square sail, and carried some twenty-odd tons of coal. When unable to run before the wind, resort was had to rowing, and this was done by a single heavy bow oar, worked on the port side by two men and a boy, while the skipper kept the course, rowing in time with a lighter oar, called a "swape," from the stern on the starboard side. The fixed rudder, hinged from the stern post and operated by a tiller, was a later development in ship construction. The Tyne "keel" exemplifies the earlier practice of our ancestors in steering by an oar from the right side of the ship, and from this comes the designation for that side as the "steer-side," or starboard.

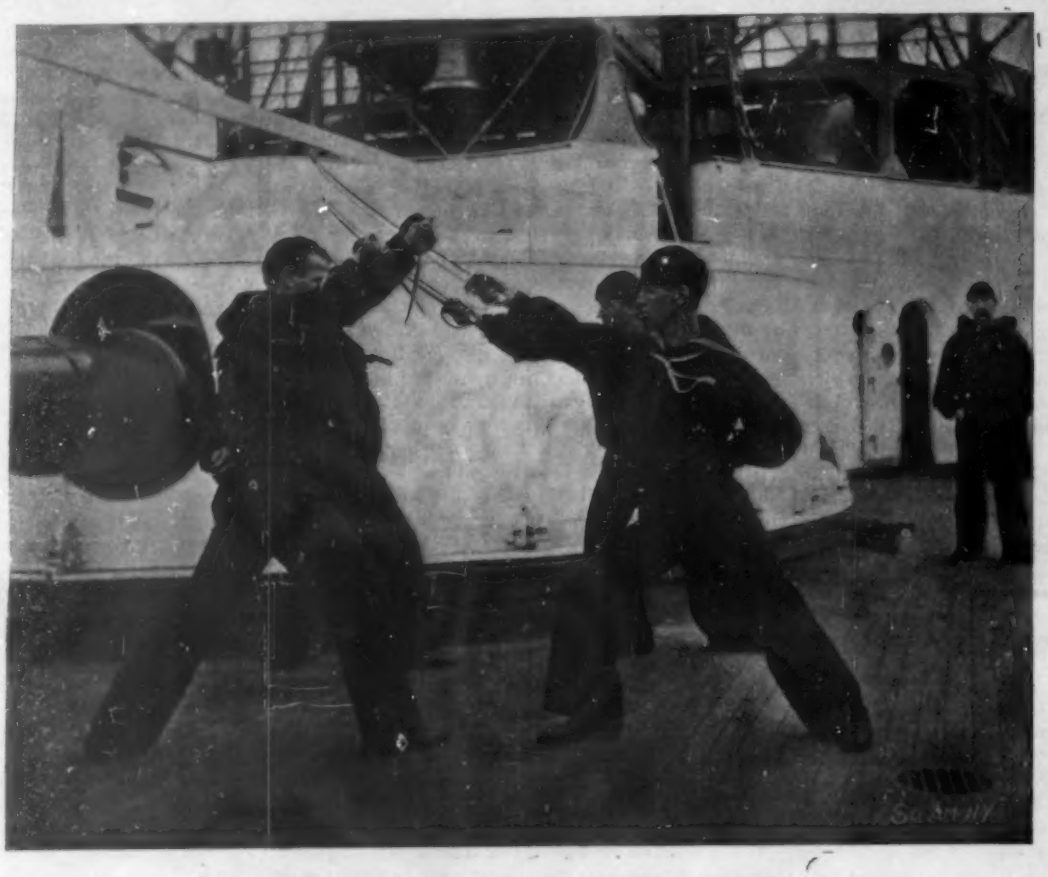
The Current Supplement.

The current SUPPLEMENT, No. 1171, contains a large number of articles of more than usual interest, notably "The History of the Stone Arch," by Prof. M. A. Howe. The installment of this important paper is accompanied by fourteen illustrations of ancient and modern stone arches. "The Metals Used by the Great Nations of Antiquity" is an interesting address by Dr. J. H. Gladstone. "American Competition in Europe" is an important consular report by Consul General F. H. Mason at Frankfort, Germany. "The Armies and Navies of the United States and Spain" illustrates the various types of men in the Spanish army and navy, showing their uniforms. "Great Britain's Neutrality" is the subject of a full page engraving showing the formal proclamation of Great Britain's neutrality outside the Royal Exchange, London. "Kites: Their Theory and Practice" by Capt. Baden-Powell is concluded in this number. For other articles of interest the reader is referred to the table of contents, page 370.

GERMAN railway statistics for 1896-97 are published in the Centralblatt der Bauverwaltung for April 6, 1898. The total length of track in operation, in 1897, was 28,626 miles of standard gage and 817·5 miles of narrow gage. During the year there were 487 derailments and 281 collisions; and in these accidents 762 persons were killed and 1,969 wounded. These figures for accidents, which probably include all casualties in switching and coupling cars, show an increase over previous records.

BROADSWORD EXERCISE ON MEN-OF-WAR.

Since the old days when vessels fought on the Spanish Main, after the adversaries had hulled each other until one of the vessels was hors de combat, "boarding" was resorted to. The sailors, literally armed to the teeth, for they often carried knives in their mouths, rushed upon the deck of the doomed vessel and with pistol, cutlass and knife fought to the death. These days are pretty much over and now when the boarding party reaches the vessel the ship has usually surrendered and the sailors are only needed to police it. Their comrades stand at the deadly rapid-fire and machine guns, and any attempt at interference with the boarding party would result in the deck of the ship being swept by a hail that nothing could withstand. It might be supposed that our modern methods of warfare, deadly though they are, would have relegated the cutlass to the limbo of things forgotten, but this is not the case, for there are still many occasions where sailors could use them effectively, as in landing troops on a hostile shore, and broadsword exercise is regarded by naval officers as an excellent means of keeping their men in a good physical condition.



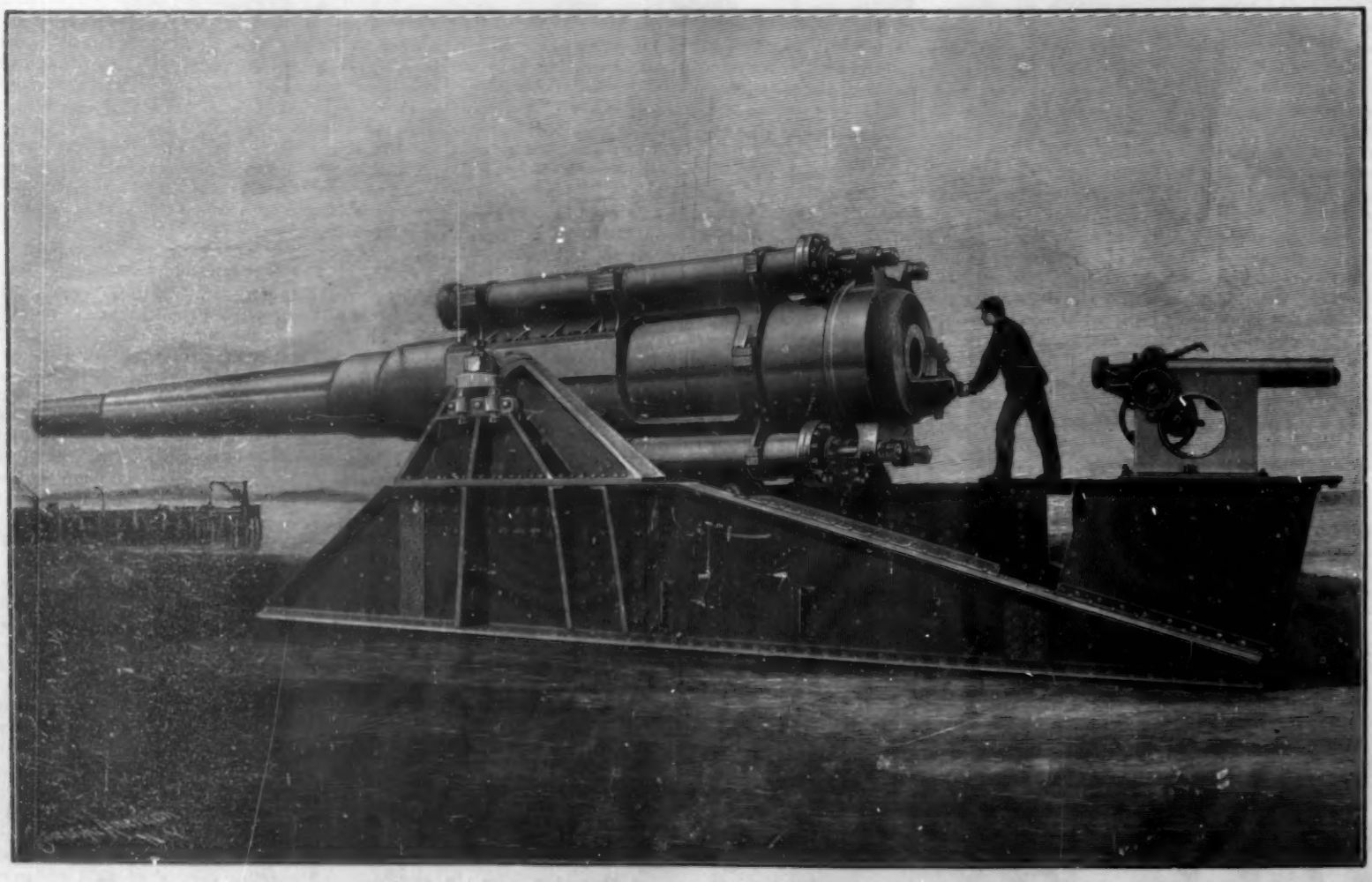
BROADSWORD EXERCISE ON THE MONITOR "TERROR."

To-day we really fight by machine, and the personal equation does not enter to any great degree as regards the larger part of the rank and file. It is obvious that in a battleship, where the bulk of the heavy work is done by some fifty distinct engines and electric motors, the occupation of the sailor is pretty well gone, unless he is also an engineer, electrician or mechanic, and there is no work aloft in modern warships provided with military masts. While this has undoubtedly limited the labors of the crew, it also makes it incumbent upon the officers to devise some substitute, so that the efficiency of the sailors shall not be impaired for lack of proper exercise which cannot be obtained in the ordinary routine, various drills have been devised. We have already illustrated the "setting up" drill, both with and without arms (see the SCIENTIFIC AMERICAN, August 14, 1897), and we now show a broadsword drill between two pairs of sailors under the lee of one of the turrets of the "Terror." The exercise is exciting and is much enjoyed by the sailors, and has a great advantage over the "setting up" drill, as the sailors exercise in pairs, thus introducing the personal element. Our engraving is reproduced from a photograph by Frank M. Boetler.

OUR NEW THIRTEEN-INCH GUNS.

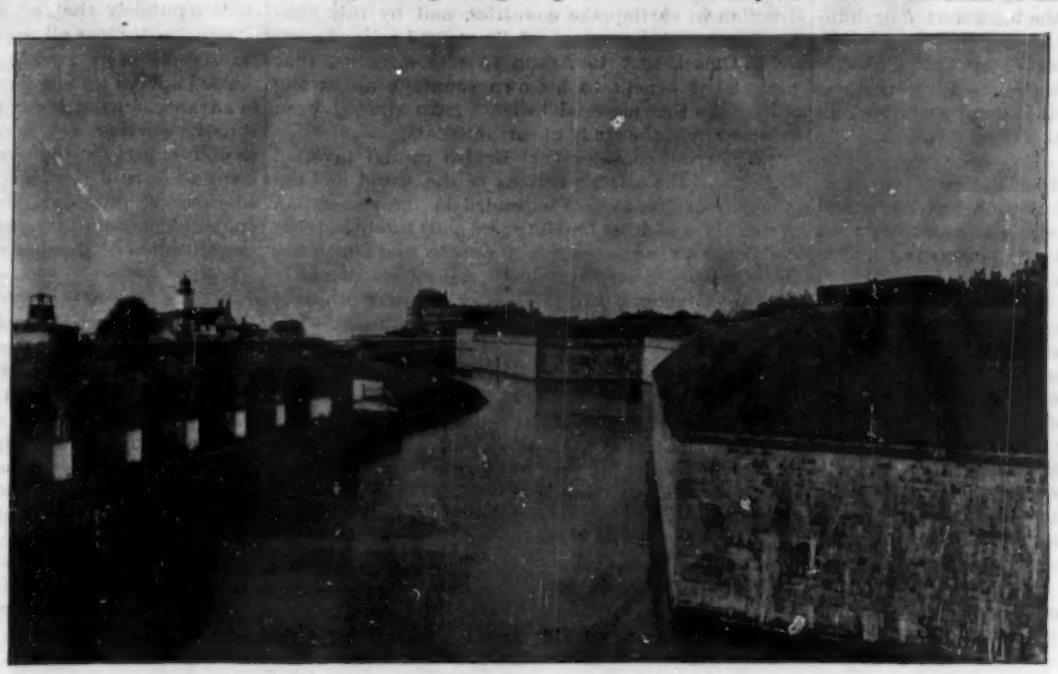
The high power rifle of to-day is the crowning feature of the modern floating fort—a battleship. Although the old gun founders cast beautiful cannon of artistic design which modern ordnance cannot approach for beauty, still the modern gun, though exceedingly plain, is a work of the highest mechanical order. The gun shown in our engraving is a 13-inch rifle with a turret mount and it is made on the "built-up" principle. Although many foreign gun makers have discarded the hooped gun, we still continue to make them, and our guns are inferior to none. The distinguishing feature of our American rifles is their great life, and one of the 10-inch guns on the "Miantonomoh" has been fired over a hundred times at the Indian Head proving grounds, and many more times after being placed on the ship. It is believed that the war with Spain will give data which may determine the average life of our 12 and 13-inch guns, but it is not expected that the war will last long enough to put any of our guns out of action on account of weakness caused by repeated firing. Out of all of the guns made at our Washington gun factory, not one has ever burst in service, while abroad gun accidents under service conditions are of not infrequent occurrence.

The navy of the United States has twenty-eight of these 13-inch guns. The battleships "Indiana," "Massachusetts," and "Oregon" have already been furnished with them, and the "Kearsarge," "Kentucky," "Alabama," and "Wisconsin" will each have four mounted in their two turrets. The gun is built of three parts, tube, jacket and hoops. The bore of the gun is formed of a tube which is of uniform diameter throughout, except where the powder chamber cuts it away. The gun is built up around this tube by shrinking on bands which, while really smaller than the tube itself, are expanded by heat and then shrunk on, producing great compression; care is of course taken to prevent the tube from being compressed beyond its elastic limit. What is termed the "jacket" is another approximately cylindrical tube which is more than one-half as long as the gun. This reinforces the tube where it is cut away for the powder chamber and also gives the necessary support for anchoring the breech mechanism. The



THIRTEEN-INCH NAVAL GUN WITH TURRET MOUNT AT THE INDIAN HEAD PROVING GROUNDS.

gun is further strengthened by additional pieces called hoops, also shrunk on. Even the jacket, in turn, is reinforced by hoops or bands, which are interlocked in an ingenious manner. The gun forgings are made from open-hearth steel, cast in ingots, each being about twice as heavy as the finished piece. The ingot is forged down, rough-bored and turned nearly the finished dimension, and test specimens are taken from one or both ends after the forging has been annealed, oil-tempered and again annealed. If satisfactory, the ingots are then accepted by the government. The pieces are then sent to the gunshop, at Washington, which is shown in our issue for February 26, 1898. The gunshop work is principally turning and boring. The work has to be done with the utmost accuracy; for shrinkage it is done to $\frac{1}{1000}$ of an inch. The tubes are bored as well as the jacket, and the hoops are also accurately turned inside. After the tube is finished, the jacket is shrunk on by heating in a furnace forty feet deep to a temperature of about 550° Fah. Twenty or thirty hours may be needed to bring it to the uniform temperature. The jacket is then lifted out of the furnace by the crane and is lowered over the tube, and if the jacket is properly heated it goes smoothly to its seat and the embryo gun is allowed to cool. Then the fore part of the tube is turned for the chase hoops, which are then put successively in place; then the jacket hoops are shrunk on in the same general way. The next operation is to finish boring the gun, and then the rear of the gun is bored out to an increased diameter to form a chamber for the powder. This is connected with the main bore by a conical portion of the bore, termed a compression slope. Back of the powder chamber is a short box of still larger diameter, termed the screw box, which has a screw thread cut on its inner surface. Then sections of this screw thread are slotted out, forming the interrupted screw for the breech plug. The exterior of the gun is now finished-turned and the bore is rifled. The gun is then ready to receive its breech mechanism. The 13-inch gun shown in our engraving has a new arrangement of the breech mechanism, which is superior to the one formerly used, which required three distinct operations: 1, turning the breech plug; 2, withdrawing the breech plug; 3, swinging the breech plug and tray away from the breech. On the shaft, below the worm wheel, is a wheel which first acts as a gear wheel on a rack fastened to the breech plug, to slide the breech plug into the screw box when the breech of the gun is to be closed, and then acts as a worm wheel on a worm rack at the end of the gear rack and at right angles to it, thus turning the breech plug and locking it in place by means of the interrupted screw. The usual gas check and firing mechanism common to all large rifles is used in this gun.



VIEW OF MOAT AT FORT MONROE, VA.

The gun is mounted in a sleeve, a key or bar is secured to the gun and fits a groove in the sleeve, which permits the gun to slide longitudinally. The recoil is taken up by four recoil cylinders, which are shown in our engraving. They are mounted in collars, the lower portion forming an integral part of the sleeve. The piston rods are attached to a ring located near the breech end of the gun, so of course they travel with the gun. In the recoil cylinders are nests of heavy springs, which take up a large part of the recoil. The movement of the pistons is also regulated by a mixture of glycerine and water in the recoil cylinders. This fluid is allowed to escape slowly past the piston by grooves in the walls of the cylinder. At the point where the gun is to be brought to rest the groove ends, consequently the motion of the gun is arrested. The sleeve holding the gun is pivoted at its front end on two trunnions. Devices are provided for elevating and depressing the gun. This work may be accomplished by hand power or by a motor. An arrangement is made for allowing the screw to yield at the moment of recoil. At the rear of the gun will be noticed the rammer, which, though only five feet long, may be extended to fourteen feet by means of tubes that telescope. Hand gear is also provided for the rammer. Our engraving, which was made from a photograph taken at the Indian Head proving ground, shows the gun on a turret mount. The gun and its mount turns with the turret, and the gun captain in the sighting hood directs the elevation and depression of the gun so as to get the proper range, sighting through a telescope secured to the sighting hood. By means of levers connected with the sleeve, the sighting telescope is always maintained in strict parallelism with the gun itself. The gun captain discharges the gun with a lanyard or by electricity.

The following data referring to the largest gun now made for the navy are of interest: Diameter of bore (caliber), 13 inches; length of gun (479·1 inches), 39 feet 9¼ inches; weight of gun, 136,000 pounds; weight of full charge of powder, 520 to 560 pounds; weight of projectile, 1,100 pounds; velocity at muzzle, 2,100 feet per second; velocity at 2,500 yards, 1,805 feet per second; thickness of steel which shell will perforate at 1,000 yards distance, 24·54 inches.

FORT McHENRY, MARYLAND.

A DIAMOND in constant use for cutting cold glass lasts about three months, but if used to cut hot glass, it would only last for one day.

SOME AMERICAN FORTS.

BY C. F. HOLDER.

The forts of the great American seaboard present an interesting spectacle at the present time, being in a state of transition. Nearly all still retain the old form and outline, but many have been adapted to modern guns and provided with defenses which will make them effective against the most powerful foe.

An examination of the old forts which gave such accounts of themselves during the civil war tells a remarkable story of the progress of military science and shows that within a few years the old methods have been completely overturned.

So radical has been the change that the government has done almost nothing with many of the old forts, and for thirty years they have been dropping to pieces in the hot sun of the Southern border, a semblance of care being taken of them by a corporal's guard stationed there to see that the property was destroyed by nature, not by man.

Among the forts attracting attention at the present time is Fort McHenry, which constitutes the defense of Baltimore. It is situated on a picturesque point and, while of an obsolete type, has some powerful modern guns which will prevent the advance of any Spanish warship in that direction.

Those who have not visited Old Point Comfort, Virginia, for several years would hardly recognize the old garrison at present. It is the center of army and navy activity. The Point is crowded with men, and has been of special importance, owing to the fact that it was the rendezvous of Commodore Schley's "Flying Squadron," before it was ordered southward.

Fort Monroe is perhaps the most important location on our entire coast line, so far as defenses are concerned, as it is supposed to command the approach to Washington, Baltimore, Richmond and many other cities of more or less importance.

Fort Monroe is the largest fort in the United States, possibly in the world, and embraces thirty or forty acres or more in its interior. It has two tiers, a casemate and parapet, is surrounded by a deep moat, and is protected by a water battery and batteries of heavy guns along the sandy beach. There are two entrances over bridges, and in the center is a fine parade ground, where are held the drills of the artillery schools. This famous school was established in 1868, and has become an important branch of the service, really a post-graduate West Point course, from which all the officers of the artillery branch of the service have graduated. It was here that the first experiments were made with 15-inch guns and sections of modern batteries and armor.

In the center of the channel stands old Fort Wool, now of little use except as a lighthouse base and a monument of past methods. The government has permitted the construction of a number of buildings on the reservation at Old Point Comfort, which might have to either come down, in case of attack, or be blown down. Such is the big hotel which rises on the beach in front of the fort to the south, almost in line with the guns on the parapet.

Passing on to Charleston, South Carolina, we have Sumter, Fort Moultrie, and many batteries, and the

harbor has been well protected by torpedoes. Sullivan's Island has the remains of many old war time batteries, and if invasion was supposed to be possible, the spot would again be occupied. Battery Beauregard was particularly famous, and at what is known as the "Cove" the first ironclad was built; being a battery of palmetto logs protected by heavy iron plate. The guns of Sumter struck this ironclad one hundred and sixty-three times with little or no effect, while the battery with its novel armament hit the brick fort four hundred and ninety times.

Savannah, Georgia, is protected by Fort Pulaski; and at the mouth of the St. Mary's River there is another fort of the old type. It is about six miles from Fernandina and stands on the beach, covering the narrow and shallow channel.

Following the coast line, we come to Key West, where Fort Taylor stands, a type of the old regime; a two-tiered fortress built in the water and connected with the mainland by a drawbridge. In case of an attack, guns in shore batteries along the sandy beach would be sufficient to prevent an invasion.

On the Gulf coast of the mainland, Pensacola has in Fort Pickens the most elaborate fort of the old school. Its position is commanding, and during the late war it occupied an important position. Fort Pickens has two tiers, and is made of brick and filled in with sand and concrete. The walls are very thick, but would hardly stand before the projectiles of to-day.

The fort was built on the generous plan of the old days, with a large parade ground, each gun occupying a large casemate, the faces being flanked by bastions which gave the fort an attractive and castlelike appearance.

While many of these forts are useless, they could all be employed as the bases of new and modern forts, and, doubtless, one result of the existing war with Spain will be the evolution of a modern fort or battery which will place our long coast line among the best armed and equipped regions of the world.

Why America is not better prepared is due to the fact that the majority of Congressmen of the past twenty or thirty years have paid more attention to politics than to informing themselves of the demands and needs of the country. It was only after a fight of years that the navy was placed on any kind of war footing, and it is only just to American officers to say that the army has been almost completely neglected. Yet within a few weeks the government has been able to supply a well-equipped force which will well maintain the honor of the nation.

FORT PICKENS, FLORIDA.

The Cost of an Indian Earthquake.

The official report from the secretary to the chief commissioner of Assam on the earthquake of June 12 last, which resulted in the loss of 1,542 lives and the destruction of an enormous quantity of property, has arrived. The cost of repairing damages in the public works department alone is estimated at more than thirty-five lacs of rupees, or, to put it moderately, over one-quarter of a million pounds sterling. These figures do not include the cost of damage to local communications chargeable to municipalities and local boards or departmental expenditure not borne by the public works department. In the circumstances, the chief commissioner is applying for a grant from imperial revenues to assist the administration to recover from the effects of the earthquake. "Here," says Prof. Milne, "we have a danger threatening life and capital which can only be avoided by the acceleration of engineering operations.

"With regard to the proposals that the various headquarters of the Assam administration shall be shifted to more favorable sites, the interference which such a step would cause to public and private interests makes it desirable that the effects of earthquakes in the future should be met, not by escape to localities where movements might be less, but by changes in the methods of construction. During late years Japan has suffered from earthquake movements probably more severely, in the ratio of nearly five to three, than that which in June last created so much destruction in Assam. . . . Profiting by experience and guided by experiment, Japanese engineers and their European colleagues have gradually departed from stereotyped methods of construction, with the result that structures of the new type, whether they are ordinary dwellings or other works, have, so far, remained standing, while what is old is slowly disappearing.

"The fact that the Japanese government annually votes from £1,000 to £5,000 to assist a committee in investigations which may result in modifying earthquake effects, has a bureau controlling the seismic survey of its country, and has appointed a professor of seismology at its university (at which all students of engineering listen to some twenty or forty lectures on construction in earthquake countries, and by this time may have read the report of its trained seismologist, Dr. F. Omori, sent to Assam to note anything that might be of benefit to his own country), are strong testimonies that material benefits have already been obtained from the study of earthquakes.

"When we consider the British capital invested throughout the seismic regions of the world and the money from time to time expended in the restoration of consular and other buildings, we must surely feel that the sooner we turn attention, if only to that which has already been done to mitigate the effects of earthquakes, the sooner will the loss of life and property which accompany such disasters be reduced."—The Architect.

Russian Copyrights.

The copyright system in Russia is so imperfect and leads to so many abuses that an imperial commission for the revision of the code has been seriously considering the question. Russia has had no copyright convention with any other state since 1887. The Pall Mall Gazette says:

When speaking at a copyright conference recently held at St. Petersburg, Mr. Spassovitch, an eminent Russian jurist, pointed out that the 125,000,000 inhabitants of the Russian empire are made up of different races, several of which have national literatures of their own. As Russia protects no translations, great injustice is often done to the Czar's own subjects. For example, Poland possesses many novelists of high and some of European repute. The instant a work appears by Pruss or by Sienkiewicz it is seized by the translators, and appears in a number of Russian journals without one kopeck finding its way into the pocket of the author. But in Russia the author is not the only sufferer; the publisher shares his hardships. Of late piracy has been assuming gigantic proportions. Russian publishers denounce the pirated works introduced from Germany. In the shops of Poland, of the Baltic provinces and of South Russia, such books abound. During the last forty years one firm in Leipzic has published (in Russian) five hundred different works by the most popular Russian novelists. And this foreign production is now more active than ever. In 1895 a German agent was actually advertising in Russia cheap editions of Russian copyright works which could be supplied to Russian booksellers from German presses. The great extent of the empire facilitates the introduction of these pirated editions. The St. Petersburg publisher with difficulty detects the proceedings of some distant provincial dealer. It is true that redress is easy in case of detection. But as the law exacts only a fine proportionate to the number of pirated copies found, the culprit, who keeps his stock low and relies on weekly supplies from Germany, gets off easily, pays his fine and continues his practices.

An analysis of the contents of fourteen leading Russian reviews and magazines revealed that 43 per cent of their contents were translations of foreign works. In one magazine the translations were 98 per cent of the whole. The serious import of these figures becomes more apparent when it is remembered that few Russian authors command a sale sufficiently certain to enable them to produce their works otherwise than in the pages of these periodicals. And that is partly because the publishers must contend with a deluge of foreign pirated editions. Even Russian authors of the first rank find themselves seriously handicapped, while outside Russia they are defenseless. Count Tolstoi, who reserves no rights, has been compelled to declare publicly that, on account of their gross inaccuracy, he declines all responsibility for certain French translations of his works.

The imperial commission has suggested several steps in advance, among them that all works published in Russia, whether by Russian subjects or foreigners, should enjoy full protection, including control of translation, and that all works of Russian subjects, wheresoever published, should have the same rights. It also recommends provisions calculated to encourage the collection of Russia's vast treasures of folk-lore.

Klondike Packers' Troubles.

A dispatch from Dyea, March 24, via Seattle, March 30, says that the white packers at the summit, to the number of several hundred, have driven off the Indian packers, who have been packing goods here every summer. Chilkoot Ike, one of the Indian packers, has appealed to Gov. Brady for protection from the white men. The Governor referred him to Deputy Marshal Cuddihee first, and instructed him that if the marshal failed to give him the desired protection, he should then appeal to Col. Anderson. It is understood that Col. Anderson will not tolerate any such action by the white men, even if they are American citizens.

The price for packing from the scales to the summit is 2 cents per pound at present. There is a perfect stream of men going up with packs on their backs. Packers make from $6 to $15 per day. The Burns hoists are working, one by horse power and one by steam. The Dyea-Klondike Company has just got its aerial tramway in operation. Other proposed tramways are not yet completed. The Burns hoists only run from the scales to the summit, and the Dyea-Klondike Company from a short distance below the scales to the summit.

Threats appeared that if the tramway companies get to working too soon the packers will take measures to stop their work, as the successful operation of the tramways will throw practically all the packers out of employment.

Over one hundred teams came in recently and joined the crowd that has been employed on the scows and hauling freight to the sheep camp. The prices for hauling from Dyea to Sheep City during the week were from 3 to 2 cents per pound. It fluctuates according to the conditions of the roads and demand. Teams have been making from $150 to $200 per day for several weeks, and many tons are yet piled up ready for forwarding. The price for having freight taken from Dyea to Lake Bennett has been in the neighborhood of $10.50 a pound. A large number of men have been taking their own outfits up the trail, either by their own muscle or by dogs, horses, oxen, or mules.

Every one is apprehensive that the road in the cañon will give out any day, when teaming with two-horse, and, in fact, with any sleds, will have to be abandoned in the cañon and the trail resorted to, says The New York Times. The price will then be advanced to 4 or 5 cents at least per pound. It is estimated that the ice in the cañon cannot last more than fourteen or fifteen days if the present mild weather continues.

Travel is proceeding regularly on the Skaguay trail. Goods are hauled through to Lake Bennett. Probably three-fourths of the people who have come here the last month have gone up by the Dyea route, but nine-tenths of those who have reached Bennett have gone over the Skaguay trail.

Many very large stocks of goods have gone by the White Pass, while the other trail has done more of the small business. When the bottom falls out of the other trails, the Skaguay wagon road and the Dyea tramways, if they are done by that time, will have their hands full of business.

CERTAIN butterflies have very transparent wings and these are thought by Haase to be even more effectual for protection than conspicuous "warning" stripes or other markings.

INDIAN KETTLES.

BY CUYLER REYNOLDS.

Summer visitors who have found health-giving recreation along the shores of America's fairest sheet of water, Lake George, can not have failed to notice at different localities certain strange and wonderful holes in the rocks, having a diameter of a foot or more and with a perfectly smooth interior, as carefully made as though a stone carver had worked them out of the solid bedrock.

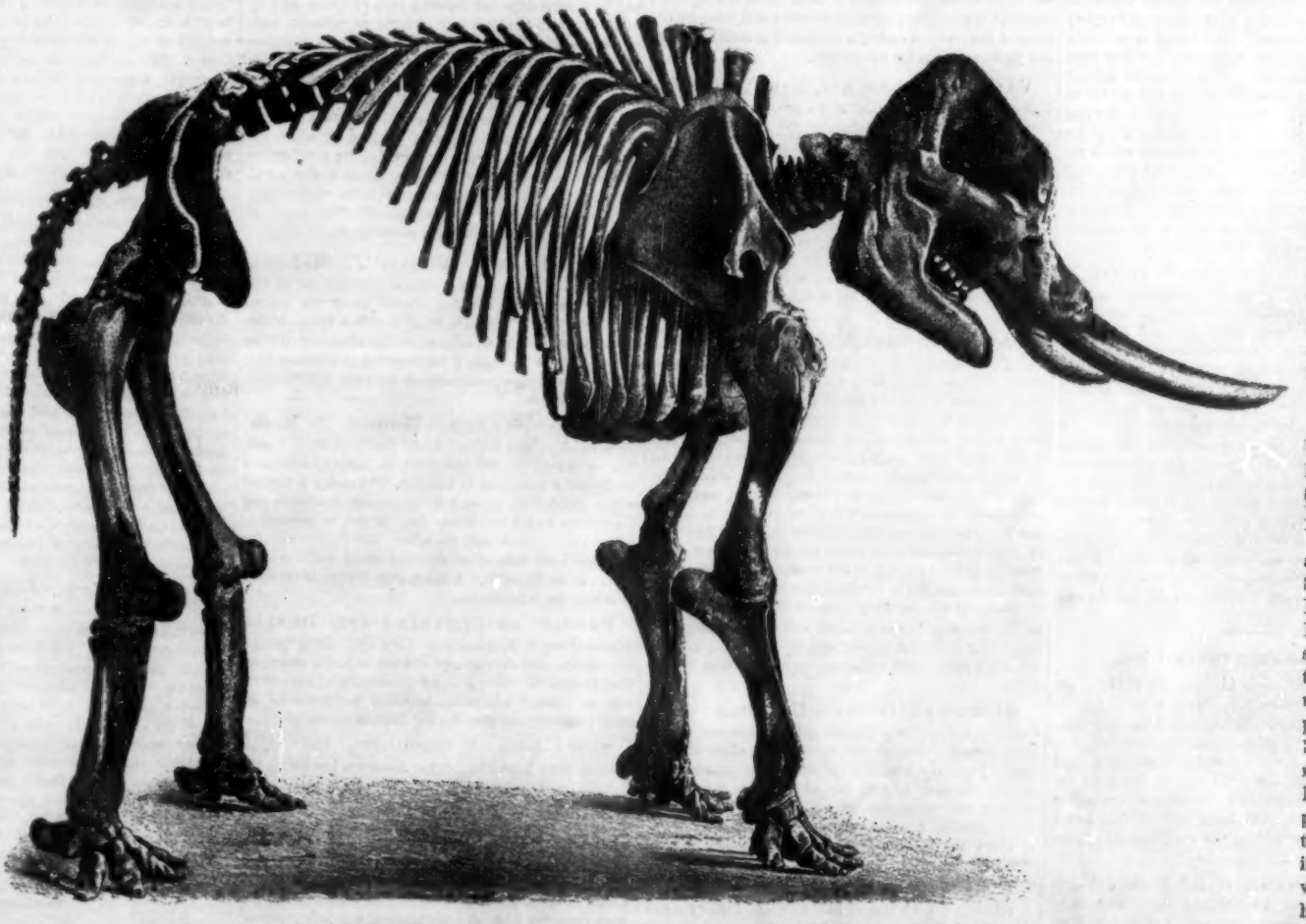
Seek information of a resident or a tourist wonted to the locality who is familiar with the sight of them, and the reply will come, "Oh, those are simply Indian kettles." When pressed further for an explanation, the fanciful answer is made that Indians who hunted in the Adirondack region, then known as the Great Northern Wilderness, hollowed out these holes in the rocks along the shores wherever they pitched their camp, and therein cooked their liquid food. But how did they heat so peculiar an oven, one without a bottom or sides, one naturally asks. A seemingly good explanation is given that the liquid was placed in the hole, a large stone, or many of them, heated and dropped in until the temperature was raised to the boiling point. In this way large quantities of soup, enough for all the camp followers, could be made. Such is the traditional or rather the mythical explanation of the "kettles" to be found in plenty along the shores of Lake George, but such is far from the true way in which these peculiar holes were constructed.

AN "INDIAN KETTLE" OR POT-HOLE.

The "kettles" are the handiwork of nature, and beautifully constructed are they. There is a more common name for them, generally bestowed in regions where Indians are forgotten, and it is that of "pot-holes."

They were made by the action of water many years ago, but to be more definite, the state geologist will tell you that they were made something over 30,000 years ago, or more than 24,000 years before the period fixed by the Bible as the time of the creation of this planet. As these holes are found far above water, it is of interest to explain how they were formed by the water.

About 50,000 years ago, almost the entire State of New York was covered by ice. The Hudson River was a frozen mass from the high ridge of hills on the one side to the other, as is shown today by corresponding erosions of the rocks caused by moving ice, on both sides. Lake George bore the same appearance. From hilltop to hilltop was a single mass. Every valley was filled. Then there came a change. There was a breaking up of this immense field, and glaciers were formed. Invariably all the glaciers of North America passed southward although the water of Lake George now flows northerly. There is a valley now from Baldwin, at the northern end of the lake, continuing southward, which is filled with water, forming the lake. Rogers Rock, an immense elevation rising abruptly with a precipitous face toward the water, is about five miles south of the town of Baldwin and on the west side of the lake. It is one of the features of this beautiful region. To the west of this elevation is another valley, now dry. When the ice broke up, one body moved southward by way of the valley, now Lake George, the other passed to the left of Rogers Rock. The two immense bodies met at the promontory just north of the hamlet of Hague, N. Y. Eddies were formed. The larger eddies were nearest the confluence of the two streams, and smaller eddies, diminishing in size, were strung along in the general course. Bowlders carried down by the fierce current were held in these eddies and passed around and around in the one spot. Knocking against the bedrock, which at this locality is crystalline limestone, they wore a hole. Gradually it increased in depth and diameter until after many years there was formed a hole of considerable size. Some of these pot-holes—and there are twenty-two of them on the one promontory of one-fourth of an acre in extent—measure 40 inches in diameter and range from 6 inches to 14 feet in depth. They occur as close together as 4 feet, and if in a virgin state are filled with muck formed of dry leaves and the water which collects there after a rain, for none has an outlet naturally. Frequently one finds in the holes the stone or a number of small stones which bored the hole. They are generally worn round, and seldom weigh more than a few pounds.



SKELETON OF MASTODON FOUND IN A POT-HOLE NEAR COHOES, N. Y.

Although the Lake George kettles are perhaps the most interesting in the country and have been seen by the greatest number of persons, they are to be found in other parts of the State of New York. In 1866, when clearing a place to establish the Harmony Knitting Mills, at Cohoes, N. Y., a large pot-hole was found. It appeared as a bog, like many a mountain pond covered with floating moss and to which there is no outlet below the surface because it is a bowl in the rock. Excavating disclosed the remains of a mastodon fifty feet below the surface. Evidently in prehistoric times the huge beast had fallen into the hole in the ground, for this one is thirty feet in diameter, and could not extricate himself because of his unwieldy form, or else his remains had been washed down with the glacier and had lodged there. The bones of this big fellow are now on exhibition in the New York State Geological rooms. It is proposed to continue the work of cleaning out these pot-holes, in order to gain information of the animal kingdom of centuries ago. In Scandinavia the pot-holes are called "Thor's kettles," and a quantity of remains of extinct animals have there been found.

In the Canajoharie limestone many "kettles" are to be found, in fact the name of that city is the Indian term for Hole-in-the-Rock. Near the town of Naples, Ontario County, N. Y., where there is a valley containing four lakes, the result of a glacial wash, and where the ice was stopped by the dirt washed down with the torrent, there are a number of them of great interest. Here the rock is sandstone. Near Lucerne, Switzerland, the glaciers have formed some beautiful eccentricities in the form of pot-holes of a variety of shapes and sizes. Visitors always spend some time at the spot, and so beautiful is the place that it is called the Glacial Garden. The Hon. Verplanck Colvin, head of the Adirondack Survey, states that he has recently discovered a pot-hole located 2,000 feet above sea-level, and several hundred feet deep, but he is not prepared to make his wonderful find public.

As they vary much in size, so do they also differ considerably in appearance. Some have a cone at the bottom, while some are flat, the surface along the sides of some is smooth as though sandpapered, while others present spiral grooves. While some are double at the top and end in a single chamber, others run down to a fine point, as though prepared for a blast of powder. All point directly downward, and a majority are large enough to admit a person's body. A man standing in a Lake George "kettle" gives an idea of their shape and size, and how these curious creations of nature look is shown in the picture. Perhaps the Lake George villagers are not far from the right when they style these pot-holes Indian kettles; for though they were not made by Indians, still they might have been put to some practical use by them, and thus the name may not be a misnomer after all.

THE Evening Post reports that the great painter, Mr. G. F. Watts, is an associate of the Society for the Protection of Birds, and feels strongly about the fashion of using the plumage of birds for millinery purposes. He is now painting a picture representing an angel with bowed head and despairing figure bending over a marble tomb covered with birds' wings, while a spirit of evil grins below.

RUSSIA has ordered a 10,000 horse power ice breaker of the Armstrongs, to cost $800,000. It will be ready in October, and will be used to keep open navigation to St. Petersburg throughout the winter.

A "Nose Competition" at Milan.

The nose has at all periods of their history possessed a peculiar significance for Italians, says The London Lancet. As a symbol of intelligence it figures in familiar speech ancient and modern, a "homo nasutissimus" being Seneca's equivalent for a very clever man and "Naso" a name held in honor by the Otacilian, Octavian, Ovidian and Voconian "gens," while "Nasica" was a cognomen of the Scipios, one of whom, Publius Scipio Nasica, was, as the most virtuous man in the state, chosen to accompany the image of the Mater Idæa to Rome. In the Italy of to-day "aver naso" and "esser di buon naso" (to have nose, to be of good nose) are the first of a series of phrases all turning on that feature in its symbolic sense, and giving rise to proverbs infinite in the variety of their application. The great Napoleon was true to his Italian origin in his preference for a "big nose," and the late Lord Beaconsfield, descended from Venetian Jews, never concealed his scorn for the "flat nosed Frank." He held, in fact, that to be "simus" was the first step toward being a "simia" or ape—a "retrocession in evolution" admitted by some among the "facts for Darwin." Such a horror have Italians of any lesion costing the face its nose or robbing the latter of its due proportions that rhinoplasty among them has long been one of the "surgical fine arts," and the great Bolognese anatomist Tagliacozzi (1546–99) has for all time given his name to an ingenious method of replacing the feature when lost. Quite in keeping, therefore, with all precedent as well as with the fitness of things, it is in Italy that we find the "cult of the nose" as vital as ever, insomuch that within the last seven years she has had two "Concorsi di Nasi" (or nose competitions) in which the owners of the feature received prizes according as they could present it in greatest perfection as regards type, size, beauty and olfactory power. The former of these "concorsi" was held in 1891, at Padua, on the initiative of the students of that medical school, and the citizens were invited "con iscbeda segreta," by universal suffrage and secret voting, to name the possessors of "i nasi più sviluppati e rispettabili" (noses the most pronounced and respectable) of the ancient Venetian town. The prizes, consisting of pocket handkerchiefs and snuff-boxes, were in due course awarded by plurality of votes. At Milan, and quite recently, a much better ordered and more conclusive competition of the same kind has just come off, the whole proceeding being controlled by a committee and the "examinations" conducted in a "Nasoteca" furnished with drawings and water colors of heads well provided with noses, such as would have gladdened the artistic sense of William Hogarth. The competitors numbered thirty-six, but not more than twenty-three appeared before the "examiners." The first prize (gold medal) was won by a Venetian, Fortunato Michielutti by name, a vendor of lucifers, whose nose was found to be of "proporzioni inquietanti, lungo, deciso, ardito, tagliente come una lama di coltello" (formidable proportions, long, well-pronounced, aggressive, trenchant like a knife blade). The second prize fell to one Antonio Pozzi, possessed of a nose "prepotente, presuntuoso, con nari larghe e cavernose" (domineering, assuming, with nostrils wide and cavernous). The award for this was a medal in enamel; while the third prize (a silver medal of the first order) was adjudged to Carlo Ascani for the refined, symmetrical proportions of his nasal feature. The last two prizes (the fourth and fifth, silver medals of the second and third order respectively) were given for a nose "without pretension, ingenuous, but solid and well planted," and for one "considerable, regular and worthy of respect." The candidates who were unsuccessful—perhaps "plowed" would be a more suggestive word—shared the festivities with which the committee concluded its labors; and so the "Concorso di Nasi" became a thing of the past, till the "Buon-temponi" (merry makers) of a future year or another city think fit to revive the harmless, not inartistic, though dubiously "scientific," competition.

How the Brain Works.

A committee of British physicians, acting jointly, has for some years been giving particular attention to this topic, and their researches, though not yet altogether complete, already show some very interesting results, which, taken together with those of investigators on the Continent, let us see a long way into the intricacies of the brain.

It has shown unequivocally, for example, that a brain cell, which is the really important part of the brain, actually loses part of its substance during action. The brain cells of persons and of animals that have died during a period of great exhaustion from overexertion are found to be greatly changed from the condition of the normal cell during times of health and vigor. The cell of the exhausted brain, instead of being plump and full of nervous matter, is found to be hollowed out or "vacuolated," a cavity within its substance having formed and being filled with water. This means that a part of the cell substance has been actually consumed during the time of brain activity, precisely as coal is consumed when one gets heat from a furnace.

It is found, further, that if an animal whose brain cells are thus exhausted is permitted to rest and to sleep, its cells rapidly recuperate, new material being supplied from the blood until the vacuolation has disappeared and the cell is practically as good as new again. This explains why sleep is necessary to our existence. During waking hours our brains are literally worn away, and sleep is the state during which the repair shops of the brain make good the damage of the waking hours. Thus the brain of a person who suffers from insomnia is in the condition of a locomotive which is run night and day without going to the repair shops. Disaster must ultimately result.

It is not sleep alone, however, that rests the brain cell, though sleep is absolutely essential to recuperation of the brain as a whole. But not all parts of the brain are involved in any one kind of mental effort. The blood supply of the brain is so arranged that, by expansion or contraction of different arteries, parts of the brain may be flushed with blood and other parts dammed off, so to speak, somewhat as the various currents of an irrigated field are regulated by the gardener. And as a rapid flow of blood is essential to great mental activity, this means that one part of the brain may be very actively at work while another part is resting and recuperating.

Thus it is that a person suffering from brain fatigue may leave his desk and go out into the fields, or on the highways with a bicycle, and by diverting his mind give the overworked cells a chance to rest and recuperate.

But it must not be overlooked that such exercise involves other brain cells, which in turn become exhausted; and that in the end, for the recuperation of the brain as a whole, sleep is absolutely essential. No recreation, no medicine, no stimulant, will take its place. The man who does not give himself sufficient hours of sleep, or who is unable to sleep when he makes the effort, is literally burning away his brain substance, and can no more keep on indefinitely in this way than a locomotive can run on indefinitely without getting fresh supplies of fuel.—San Francisco Call.

RECENTLY PATENTED INVENTIONS.

Mechanical Devices.

MACHINE FOR SUPERPOSING CLOTHS.—Henri Edouard Cousinean, Lille, France. Briefly described, this machine comprises an endless carrier or apron, partly solid and partly open, mounted to travel over a table or other support. The apron is provided with a clamp or other suitable holder for the free edge of the cloth or other material, and an abutment secured to the table or frame is adapted to engage the holder to open it. The material is first seized by the holder and drawn on the solid portion of the apron. Then the holder or clamp opens to release the material, which remains stationary. The apron continues to move, and gradually its open portion comes under the material, finally allowing the latter to drop through the opening of the apron on the lower layers or folds of the material. The material is then cut and the operation repeated.

ROPE-MAKING MACHINE.—Harry I. Hansen, Boonton, N. J. In this rope-making machine a bar of the flier is provided with a longitudinal slot in one face and a wider longitudinal slot in its opposite face, together with a longitudinal rib extending along the wider slot and stopping short of its ends, the walls of the wider slot being provided with teeth. A traverse is mounted to travel on the bar of the flier and has a guide wheel arranged to enter the annular slot in the bar. A driving wheel is held in engagement with the toothed wall of the wider slot. The yarn or rope is carried over a pulley. A driving connection is provided between the pulley and the driving wheel of the traverse. By this machine a ready means is provided for removing or introducing the bobbin in the flier. The feed-cone can be removed and larger or smaller ones substituted. A support is provided for the outer end of the shaft on which the bobbin turns, which support can be quickly and easily manipulated.

Miscellaneous Inventions.

TABLE.—Alfred N. Heine and Gustav A. Nouweiler, Evansville, Ind. With a table top are connected rails cut away at the top at their meeting ends. A leg has a projecting plate on its upper end to engage in the cut-away portion of the rails and a diagonally extending bridge is secured to the under side of the table top and is notched in its upper edge. A wedge is designed to pass through the notch and engage with the leg, and a block is provided for holding the wedge tightly against the leg and its plate.

WINDOW-SHADE.—John S. Judge, Peterborough, Canada. This window shade consists of a series of slats pivotally connected together and arranged in pairs, each pair of slats at opposite ends being provided with roller bearings spring-pressed in an outward direction. The window frame is provided with a tubular guide formed with a longitudinal slot. Tension devices in the guide are connected through the slot with sundry of the slats, whereby the slats may be held at any desired height.

BACK-REST FOR VEHICLE SEATS.—Eugene C. Alford, Portland, Ore. In this rest for vehicle seats, the seat is connected with a back-rest ranging transversely at the rear of the seat, two braces being attached to the back rest and extending downward and pivotally mounted on the seat at the rear portion thereof. Two rods are pivotally connected with the respective ends of the back-rest and extend forwardly. The rods are furthermore respectively slidable in two cylinders mounted at their front portions to swing at the respective sides of the seat. A spring is contained in each cylinder and presses against the rod therein.

VALVE.—Mathew Abt, New York city. The object of this invention is to provide a valve for steam heating radiators whereby the inlet and outlet valves may be simultaneously operated, obviating the danger of leaving one valve open and the other closed. The valve comprises a casing with two chambers separated by a tubular guide. A nut movable in the guide forms a closure for slots on each side of the chambers. Arms integral with the nut extend through the slots and are connected to the valves of the inlet and outlet openings. A screw rod engages the nut and by its means both valves are simultaneously opened or closed.

STOVE.—Ernest C. Cole, Council Bluffs, Ia. The improvement of this inventor is chiefly concerned with the ash-pit and elbow-door. The object of the inventor is to secure a tighter connection of the elbow or jamb with the body of the stove. A sheet-metal collar is forced into a cast-iron elbow and is secured within the latter at a point remote from the extreme heat. By this construction the contact between the sheet-metal collar and the sheet-metal stove-body is tight, because in both parts the expansion will be equal. The invention also seeks to overcome the difficulty resulting from the projection of hinge-studs above the surface of either the door or jamb and permits the grinding of the door and jamb to an air-tight fit on the surface of a grinding wheel. By reason of the double hinge-joint the two surfaces can adjust themselves to an air-tight fit in spite of great variations in grinding off the surfaces or in drilling sockets for hinge-pins, which variations constantly occur in such work.

MITER-SAW GUIDE.—Hamilton Weir, La Porte, Ind. This miter-saw guide comprises a cap-plate having a curved slot, a hanger to which the cap-plate is jointed, a main-plate pivoted to the cap-plate and movable thereon to different adjustments, a screw for securing the main-plate in its different adjustments, clamp-sections hinged together, a spreading device by which the clamp-sections may be adjusted, and ribs or rails by which the moving clamp sections are held to the main-plate.

DISH-CLEANER.—Robert R. Parry and Edwin Evans, Poultney, Vt. According to this invention, a dish-washing machine, comprising a reservoir, is provided with a cover and carrier rings mounted to rotate in the reservoir and cover. Means are also provided for raising and supporting the carrier rings above the water in the reservoir. A series of open-work receptacles contain the dishes to be washed, the receptacles being arranged to conform to the interior of the carrier rings. A brush is secured to the carrier rings and the dishes are held in the reservoir outside the carrier. With this machine the labor of dish-washing is much reduced, and the reservoir and cover being closed during the operation, there is no discomfort from rising steam.

POTATO-BUG DESTROYER.—Christian Nelson and Henry F. S. Justeson, Arrowsmith, Ill. The object of this invention is to provide a machine which may be quickly adjusted between rows of vines and by means of which the bugs may be removed without tearing or breaking the vines. The machine has a platform which is placed between two rows of vines, the platform having laterally sliding sections curved upward at the outer edge. Longitudinally tapered gathering rollers at the sides of the platform project with their forward ends over the vines at the side opposite to that in which the platform is placed. Means are provided for rotating the rollers. Crushing rollers extending along a slot longitudinally formed in the platform receive the bugs as they drop on the platform and kill them. The edges of the fixed plates of the platform keep the rollers clean.

BANJO-BELL.—William J. McLean, New York city. The improvement provided for by this inventor consists in forming a flange about the central opening in the bell and attaching thereto a flange or ring which is adjustable, so as to vary the thickness of the device and accommodate it for insertion in different banjos in which the distance between the head and the neck extension varies.

WINDOW-SCREEN.—Bennett J. Kolb, Florence, Ky., and Michael Kolb, Newport, Ky. A netting or screen in this invention is made to wind on a screen-roller contained in a casing. The casing is formed with a slot for the passage of the screen and on its end is provided with a removable cap. A rod is secured to this cap and extends into the roller. On the rod a spring is coiled and secured at one end to the rod and at its other end to the roller. A bearing on the cap is provided on which the roller turns.

PROCESS OF CLEANING AND DRYING EGGS.—John A. Kunkel, New York city. This process for cleaning and drying eggs without injuring them consists in cleaning the eggs in a weak solution of a vegetable acid, as vinegar, and soda, in water having cornmeal stirred therein, and then drying them in cornmeal.

SAW.—John I. Caruthers, 156 Fifth Avenue, New York city. This invention has for its object the provision of a saw with the teeth so arranged as to cut during both the back and forth movements and also so arranged as to clear the kerf of sawdust. The saw has the front sides of its teeth arranged at a slight incline relatively to the blade and the rear sides arranged at a greater incline. The teeth are beveled outwardly from their longitudinal centers, the inner end of a tooth engaging with and terminating at a point between the inner and outer ends of the front portion of an adjacent tooth.

BOW-FACING OAR.—Thomas H. Brosnihan, Livermore Falls, Me. The object of this invention is to provide improvements whereby the operator can readily manipulate the oars to insure a proper and easy propulsion of a boat with a minimum exertion on the part of the operator. The device consists principally of a rock-frame, an oar holder pivoted on the frame, and a connection of special construction between the handle and the oar holder to impart a swinging motion to the same.

VACUUM PAN.—Henry G. Boswell, Lihue, Kauai, Hawaii. This vacuum pan is designed for use in sugar-making, and by its means the liquids carried by the vapors in the generating pan are readily separated from the vapors and the latter are not deflected in the pan or obstructed in their passage from the pan to the condenser. The pan has an outlet orifice and a number of depending cup-shaped screens fitting one within the other and spaced apart from one another. The screens are foraminous at the bottom and sides and arranged under the orifice and within the vacuum pan. The vapors passing from the pan will thus be separated from the liquids that may be therein suspended.

PRIVY-STOOL.—William G. Bliss, Constantinople, Turkey. The object of this invention is to enable a person to avoid personal contact with frequently foul and sometimes infected seats, the invention at the same time permitting the stool to be used in the ordinary manner, if desired. The stool is provided with the usual basin, and a pan or tray having an opening is mounted on the basin, so that the opening will register with the basin. The pan or tray is extended horizontally beyond the sides of the basin and has a smooth top surface inclined gradually toward the opening in the pan or tray. Two series of parallel ribs are formed on the top surface of the pan or tray at the horizontally extended portions thereof and located one series at each side of the opening therein, such ribs forming raised gratings on which the feet of a person may rest. A weighted seat is horizontally mounted adjacent to the basin and normally extends perpendicularly to expose the pan or tray, the seat being capable of swinging downward to cover the pan or tray.

FUNERAL-CAR.—James Burns, Cincinnati, O. The car provided for in this invention is adapted to carry funeral-biers and other appurtenances used in funeral ceremonies. The invention may also be used in railway cars for transporting fire-engines and similar vehicles. The car is provided with rails upon which a removable floor portion is carried and movable in and out of the car. A removable sill is held on the car and a sliding panel is capable of moving on and off the same to permit the displacement of the floor portion. In operation the movable floor is lowered by means of the rails, and the bier placed upon the floor. By means of ropes attached to the floor the bier is raised into the car. The rails may then be folded out of the way under the car, and the sliding panels closed.

Designs.

MOULD FOR PAVING-BLOCKS.—John L. Adams, New York city. In this design side walls and end walls are so grouped as to form a skeleton figure of the shape of a parallelogram. Partitions in the figure are diagonally arranged and appear integral with the surfaces that they connect.

LOCKET.—Tillie J. Zeltmacher, New York city. This locket consists of a slide-body in which a depression is formed. A frame surrounds the depression and receives a panel transparent in appearance.

A flange of the body extends beyond the frame and a cap-member connected with the body within the periphery of the flange is given an interior configuration corresponding to the outer surface configuration of the panel and frame.

TEAPOT OR LIKE ARTICLE.—Austin F. Jackson, Taunton, Mass. The body of this teapot is oblong in horizontal section. The large lower portion is of convex outline and the smaller upper portion of concave outline. The base is of a shape corresponding generally to the body portion, spreads out beneath the lower portion of the body and has on each side a symmetrical ornament of a double scroll pattern. A similar ornament is arranged at the margin of the upper portion on each side. The spout is of reversely curved outline and has on its lower end or root portion a series of scallops joining onto the body portion. Scrolls are arranged at the top and bottom of the spout. The top is conical, with reversely curved sides concave at the bottom and convex at the top, with a series of upwardly converging corrugations. The handle is scalloped in cross-section and has a spreading root portion where it joins onto the upper portion of the body and a scalloped scroll on either side. The handle is otherwise ornamented with many beautiful decorations.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send the name of the patentee, title of invention, and date of this paper.

NEW BOOKS, ETC.

DIZIONARIO TECNICO IN QUATTRO LINGUE. III. Milan: U. Hoepli. 1898. Pp. 509.

This little technical dictionary is in English, Italian, German and French. It is a work which has long been needed. It is a most useful dictionary and should be on the desks of all those who read foreign technical books and periodicals.

SALVA-WEBSTER SPANISH-ENGLISH AND ENGLISH-SPANISH DICTIONARY. Chicago: Laird & Lee. Pp. 400. Price, limp cloth, 30 cents; stiff cloth, 60 cents.

This compact little work cannot fail to be a great convenience, at the present time, to all who desire to keep in touch with the news of the day, when so much of intense interest is happening in our relations with Spain and the Spaniards in Cuba. It also contains a geographical and biographical cyclopedia of Spanish-speaking countries, with maps, etc.

A TEXT BOOK OF BOTANY. By Dr. E. Strasburger, Dr. Fritz Noll, Dr. H. Schenck, Dr. A. F. W. Schimper. Translated from the German by H. C. Porter. With 594 illustrations, in part colored. London and New York: Macmillan & Company. 1898. Pp. 632. Price $4.50.

No words of commendation are needed for this translation of Strasburger's botany. The names of its authors and the distinguished position they occupy in the world of botanical science testify to the high character of the book. Embodying the well considered conclusions of a lifetime devoted to botanical work on the part of its chief editor, Dr. Strasburger, and the investigations of his able collaborators, it will be found to include all the latest results of botanical study and research. The great thoroughness which is the marked characteristic of German scholarship is admirably exemplified in the present book. It is very difficult to find satisfactory equivalents for German terms, and the translator appears to have accomplished this task with great felicity. The work is divided into two parts—I., general botany, including morphology and physiology, and part II., special botany. The book contains 594 illustrations, part of them being colored. It is beautifully printed on fine paper and is a splendid example of a modern science text book.

FOSSIL PLANTS FOR STUDENTS OF BOTANY AND GEOLOGY. By A. C. Seward. With illustrations. Vol I. Cambridge: University Press. New York: Macmillan Company. 1898. Pp. xviii, 452. Price $3.

The present work is the first volume of an important contribution to paleobotany. This subject does not readily lend itself to adequate treatment in a work intended for both geological and botanical students. The botanist and geologist are not always acquainted with each others' subjects in a sufficient degree to appreciate the significance of paleobotany in its several points of contact with geology and recent botany. The author has endeavored to bear in mind the possibility that the pages of his book will be read by both non-geological and non-botanical students. His plan has been to deal in some detail with certain selected types, and to refer briefly to such others as should be studied by any one desirous of pursuing the subject more thoroughly, than to cover a wide range or to attempt to make the list of types complete. A second volume is promised which will contain such interesting features as geological flora, plants as rock builders, fossil plants and evolution. The present volume is well illustrated and shows a wonderful amount of research.

AMERICAN RAILWAY BRIDGES AND BUILDINGS. Official Reports, Association Railway Superintendents Bridges and Buildings. Compiled and edited by Walter G. Berg. Chicago: The Roadmaster and Foreman. 1898. Pp. 706. Price $2.50.

In this progressive age the best results are obtained by applying past experiences to the problems of today. The department of bridges and buildings of American railroads is a very important division of railway administration, and the only authentic published records of the various kinds of work coming under this head are the annual reports of the Association of Railway Superintendents of Bridges and Buildings. They were issued only in limited numbers and the form was not the most desirable. In order to extend the usefulness of these reports and to make them available for every one, the reports and information collected by the association during the last seven years have been compiled and edited by W. G. Berg, principal assistant engineer of the Lehigh Valley Railroad and president of the association, and are published in a form suitable for a handy reference book. It is profusely illustrated.

GOLD DUST. How to find it and how to mine it. By Philip Minor. Seattle, Washington. 1898. Pp. 39. Price 25 cents.

The little pamphlet is brimful of exactly the kind of information which those who are interested in mining or prospecting always want to know. It gives a great deal of important information in a handy and inexpensive form. The only part of the book which we are disposed to criticise is the medical advice, but it is not probable that the purchasers of the work will go to a book of this kind for medical advice.

THE MANUFACTURE OF GLUE AND GELATINE. The application and uses of machinery, etc. Complete list of manufacturers and dealers in the United States and Canada. New York: The National Provisioner Publishing Company. 1898. Pp. 223. Price $10.

The manufacturers of glue have made special effort to keep their methods and processes as secret as possible; so that the literature upon the subject is very limited. Nearly every manufacturer has some little arrangement, machine or device which enables him to economize in some way or other, so that the National Provisioner has done wisely in collecting the writings of men who are entirely familiar with the various processes of making glue and gelatine. The result is a very helpful book, which may be regarded as one of the most important contributions ever made to the subject. The book is handsomely printed and bound and is well illustrated. It also includes a complete list of manufacturers and dealers in glue and gelatine in the United States and Canada.

WOOD WORKERS' TOOLS. Being a catalogue of tools, supplies, machinery and similar goods. Detroit, Mich.: Charles A. Strelinger & Company. Pp. 400. Price 25 cents.

That a catalogue of tools is not always dry and uninteresting is proved by the catalogue of the firm referred to above. It treats of tools, machinery and supplies. For many years catalogues have been growing larger and larger, until things were getting to such a pass that it almost became a grave question as to whether manufacturers would not have to put up special library buildings for trade catalogues. That a catalogue need not, however, be an enormous folio is evidenced by the catalogue which we are noticing. A small engraving tends, in a majority of cases, to be as useful for the purpose as a large one. On account of its small size this book can be kept on the desk and constantly referred to or it can be carried in the pocket. Besides being a catalogue of tools in the ordinary sense of the word, the catalogue contains a large amount of information on the use of tools which will prove available to every amateur and even to those who use tools as a means of livelihood. The catalogue is admirably got up and is in reality a valuable reference book. There are 2,258 illustrations, besides plates which illustrate the "Elements of Descriptive Geometry as Applied to the Trades."

PATENTED TELEPHONY. A Review of the Patents Pertaining to Telephones and Telephonic Apparatus. By the American Electrical Engineering Association. Chicago, Ill. 1897. Pp. 102. Price $1.50.

A review of the principal patents pertaining to telephones and telephone apparatus, in a simple form, is a novel idea. This treatise is designed as a reference book for the inventor, engineer and patent lawyer. The United States patents now in force which cover devices and systems used in telephones, number thousands. The present work gives the salient features, the high lights in the art, as it were, which are revealed by the study of both expired and unexpired patents. It is well illustrated by the reproductions of patent drawings.

RESEARCHES UPON THE ANTIQUITY OF MAN. At an Indian Stone Blade Quarry in the Delaware Valley, at a Mortuary Deposit of Indian Skeletons in Maryland, in Certain Shell Heaps on the Coast of Maine and at the Durham Cave and Indian House Rockshelter in Pennsylvania. By Henry C. Mercer. Boston: Ginn & Company. 1897. Pp. 178.

A valuable archæological study fully illustrated with maps, plans and well executed engravings.

"Monumental Records" is the name of a new journal devoted to archæology. It is edited by Rev. H. Mason Baum, and the subscription price is $1.50 per annum. It is published in New York City, P. O. Box 1829. It is a mistake to believe that archæology is a dull and uninteresting science. The reverse is quite the case, and it is refreshing to see a journal devoted to archæology which is adequately illustrated by modern processes. It is to be hoped that all those who are interested in this charming science will become subscribers to this journal, whose field is the world, and it appeals to the intelligent and cultivated public which is interested in discoveries that are being made in ancient centers of civilization. Too often discoveries are made known only by the reports of societies and expensive monographs. Up to this time there has been no periodical exclusively devoted to exploration from which the public could get a reliable and popular account.

Business and Personal.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7446) W. J. K. asks: 1. What is it in an electric current that produces the shock—the amperes or volts? A. There are two quite different modes in which electricity affects the body. These are by shock and by electrolysis. Your questions relate to the effect of shock. In this a very high voltage is essential. In either case, there must be voltage sufficient to overcome the resistance of the body, which may be from 300 to 10,000 ohms, according to the dryness of the skin. 2. I have read that if there be an exceedingly high potential, there will be no shock. Is this true? A. Certain experiments performed by Tesla are relied upon as proof of this statement. It should, however, be said that it is not universally believed that there is no shock with the highest voltages. 3. Why is it that a broken or alternate current will give more of a shock than a direct one of the same voltage and amperes? A. Because with an alternating current the shocks are given in opposite directions so rapidly and with such violence.

(7447) C. A. asks: 1. Will you kindly let me know how many cells are required for a current of 20 amperes at 10 volts? A. To obtain 20 amperes at 10 volts, with a primary battery, is not easy. If you use the plunge type, its E. M. F. is about 1·8 volts per cell. You will need 6 cells in a series for the voltage. The maximum current of this cell is 4 amperes. You should have 6 such series to be sure of 20 amperes, making 36 cells in your battery. 2. Is it advisable to use plunge batteries with large plates? A. For occasional use and for a short time the plunge battery is as good as any, except the storage. 3. How shall I wind my motor? A. You can find a small motor described in Parkhurst's "Motor Building for Amateurs." Price $1 by mail. Or in Watson's "Quarter Horse Power Motor." Price 50 cents by mail.

(7448) O. H. D. says: Can you tell me how to make blank wax cylinders for use in connection with graphophone or phonograph? A. We do not know what the wax cylinders are composed of or how they are made. This is a trade secret.

(7449) J. E. R. asks: What is the cost of firing 6, 8, 10, 12 and 13-inch guns? A. The cost of firing large guns is said to be as follows: 6-inch, $100; 8-inch, $250; 10 inch, $400; 12-inch, $600; 13-inch, $800.

(7450) R. I. B. asks: Does a 13-inch gun refer to the caliber of the projectile or to the distance which it will carry? A. As its name implies, a 13-inch gun is a gun with a caliber of 13 inches.

(7451) C. H. S. asks: 1. Is there any difference in the resistance of iron and steel wire? A. Steel wire has a higher resistance than iron wire of same size. If various grades of iron have resistances represented by the numbers 9 to 15, various grades of steel will have resistances represented by the numbers 15 to 43. [Kohlrausch.] 2. Is galvanized steel wire suitable for telegraph and telephone lines? If not, why? A. Yes. 3. How many carbon rods one-half inch diameter should be used in a bichromate battery in place of two strips 2×½×6 inches? A. The surface of the carbon rods must be equal to that of the plates. In this case five rods 6 inches long are required. 4. What is the output in amperes of a pint bichromate cell? A. The rate of output depends on the size of the plates. A pint cell will probably deliver 2 amperes. Its ampere hours depend on the amount of solution to be decomposed. This may be 20 to 30, or perhaps somewhat more.

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(Continued on page 389)

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